THE

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EARTH CONNECTIONS.

REGARDED as an electrical conductor, the earth, in most localities, offers practically no appreciable resistance, no matter how far apart the electrodes may be situated. Yet it is extraordinarily hard to devise a method of utilising its conductance efficiently, owing to the difficulty experienced in making an effective connection with a mass of material of low specific conductivity. On the other hand, where high voltages or small currents are concerned, and a high resistance in the circuit is of little consequence, nothing is easier than to effect an earth connection. Thus it is that a telephone circuit can be provided with a satisfactory "earth" on occasion by simply sticking the blade of a pocket knife or a screw-driver into the ground, or a person can receive a fatal shock from a high-pressure circuit whilst standing on a stone floor and wearing leather boots; in the latter case, it is not even necessary for the circuit to be earthed at any particular point, as sufficient current may pass through the general leakage of the system, or through the condenser formed by line and earth, to produce a fatal result.

The importance of the subject is indicated by the elaborate regulations which have been made by Government Departments for the efficient earthing of all metal parts in the vicinity of electrical apparatus in workshops and mines, in order to provide an alternative path of low resistance in shunt with the body of any person who may touch them when they by chance have become "live." It should always be remembered that this "earthing" is not absolute, but is, as above-mentioned, only a shunt, and therefore that if the resistance of the earth connection is, or becomes, comparatively high, the device ceases to afford protection to the person.

It will be seen, therefore, that any kind of an earth does not give adequate protection; a really good low-resistance earth should be provided, and this is not an easy matter. Many investigations have been carried out on the subject, but the results are scattered amongst the pages of periodicals, proceedings of societies, &c., and therefore we are glad to draw attention to an important treatise, comprising some 200 pages, which was recently issued by the Bureau of Standards.* This paper embodies the results of an extended investigation of methods of earthing electrical circuits and lightning rods which has been carried out by the Bureau; the subject is treated from both the practical and the theoretical point of view, and includes an abundance of data relating to actual installations. The author lays down the rule that "for a high degree of safety to life, the resistance of the ground connection should be such that, with a current flow equal to the rated current of the nearest circuit-breaker which will operate to disconnect the equipment or circuit concerned from the source of the dangerous voltage in the event of an accident to insulation, the

* Technologic Paper No. 108: "Ground Connections for Electrical Systems." By O. S. Peters. Washington, U.S.A.: Government Printing Office. Price 30 cents.

potential difference between ground wire and ground will not exceed 150 volts, if the ground wire or circuit is accessible."

By far the best earth connection, of course, is a water supply pipe, and where there is no likelihood of a continuous flow of current sufficient to cause electrolysis, there is no objection to its use. Where water pipes are not available, the author states that the best earth consists of pipes from 1 in. to 2 in. in diameter, driven down to a permanently moist stratum of soil; where the depth of soil is insufficient to give a reliable earth by this means, buried plates, or, preferably, long narrow strips of metal laid in trenches, may be used, but their efficiency cannot be compared with that of water pipes, which generally have a resistance of much less than one ohm, whereas a pipe driven 10 ft. deep offers an earth resistance of the order of 20 ohms. Several pipes connected in parallel are preferable to a single pipe, and, similarly, two small plates buried 10 ft. or 20 ft. apart give a better earth connection, with half the surface, than one large plate. The use of salt in large quantities, and of a bed of coke, to increase the conductance of the moisture and to enlarge the contact surface respectively, is recommended, but with the reservation that the life of the earth-plate will thereby be reduced owing to corrosion, especially when coke is used. Attention is drawn to the high potential gradient which may exist on the surface of the ground near the earth connection, particularly when a current has flowed to earth long enough to produce appreciable heating and to dry the soil to some extent; the gradient may easily be such as to give a dangerous shock to a person or an animal standing on the ground, and as the highest potential, of course, exists at the earthing conductor itself, this should be guarded, as well as the top of a driven pipe. When buried plates are used, with insulated leads attached to them, this danger is absent. The joints between the leads and earth plates or pipes are best made underground, and protected with concrete. Periodical inspection and testing of earth connections, at least once a year, is urgently necessary for safety. Not the least interesting feature of this work is a collection of some hundreds of tests of artificial earths in American towns, some of which show that an earth connection made on sound lines may yet, owing to some local condition, have a resistance of more than 2,000 ohms, whilst very many are over 100 ohms. Sand, gravel, and stones are particularly unfavourable constituents of the soil from the point of view of earthing. We strongly recommend this valuable paper to all who are called upon to make good earths.

Government and Industry.

THE third of the Saddlers' Hall series of lectures arranged by the Industrial Reconstruction Council was delivered on October 30th. In our opinion, it was of greater immediate practical value than either of the preceding lectures of the series, both of which were delivered by members of the Government (the President of the Board of Trade and the Minister of Reconstruction), and covered ground which was more or less familiar. Both of these gentlemen gave us an account of many things that are proposed as the result of investigations by various Committees which have inquired into certain defined sections of activity. On the third occasion the lecturer (Mr. W. L. Hichens, chairman of Cammell, Laird & Co., Ltd.) was a man free from all Government influences officially, but by no means as free therefrom as he would desire to be as a representative of great national industries. He was, therefore, agreeably unrestrained in dealing with the subject chosen for his lecture, and, in our opinion, the importance and seriousness of what he had to say were fully appreciated by his audience. We may all have the best intentions in the world in trying to obviate causes of friction in the nation in the approaching days, but we shall be pursuing a rake's progress if we sit still and see security of industrial interests threatened with wearing away to vanishing point because Parliamentary authorities adopt policies dictated by opportunism. There are many voices in the nation at the present moment. Some of them are very loud, and what they say is very emphatically expressed; but inasmuch as "the people" can only live by what industry affords them, it is very necessary that when we are in danger of being carried along on a great wave of good feeling we should ask ourselves whither that great wave is likely to carry us. As Mr. Hichens says, it is a natural weakness of Englishmen "to drift down the stream of life without inquiring where they are going." His advice is that we should pause a moment at the veritable network of cross-roads that meets us to-day, and make up our minds where it is we want to go. Changing over from stream and cross-road similes, he very aptly likens the nation to a traveller at a railway station. He has to go somewhere, the train is waiting to be off, and, without inquiring its destination, he jumps in, and when he is settled comfortably begins to reflect, and soon hopes that there may be some "compromise junction" at which he can alight and change over before he is landed at the unknown end. But suppose it is a non-stop train, or there is no "compromise junction," or if there is, we are stranded there against our inclinations—what then? The lecturer, like many another who has the well-being of the nation at heart, has no desire to find himself in a non-stop train hurrying headlong to the destination of State Socialism. He objects to being pushed and jostled into the wrong train by a crowd of men and women in a hurry, and prefers, if he can, to travel by another route; but, to our mind, the danger of the present situation lies in the great pressure that is gathering behind us, or behind those who during the war have had to give way here, and give way there, in order to win the war. We have made many compromises during the war, and the Government has controlled us all. For a time it will continue to do so, as we feel our way along the rough and tortuous paths of Peace. But after the transition period—what then? Not blind leaders of the blind—worse than that unless we determine our course now—blind leaders of the open-eyed! With our ripe experience of the crass absurdities, the deplorable delays, and the restrictions on initiative and enterprise, that excessive Government control has meant during these last four years, are we going to be carried irresistibly upon the flood tide to the nationalisation of a host of services and industries? If our measures for reconstruction seem likely to lead us there, we shall do well to pause, and consider our ways. The principle of Government control has been, and is, necessary up to a point under war conditions; no nation has been able to avoid it. But we have been pouring out State capital and paying State wages with a prodigal hand, and not even an idealist can imagine that we can continue along such a course with depleted resources without finding our way to bankruptcy and to universal disaster. It is suggested by some that such a view is held only by pessimists who take no account of movements of recent days in creating a harmonious atmosphere. But the man who waves a red flag on the railway track may save us from the fate that awaits us if the driver of our non-stop train wears a significant red tie, or a red ribbon in his buttonhole. If the lecturer were unsympathetically disposed towards the best interests of the masses, his warnings against excessive nationalisation might be regarded as a piece of special pleading on behalf of Capital, and he might be denounced by some sections of the community because of a supposed desire to continue the defects that accompany the existing order of society. But from his previous utterances printed in these pages it is perfectly clear that such is not the case. He holds that the State should be the arbitrator between Capital and Labour, and even goes so far as to agree with Labour that the return on capital should be decided by Government, and that the hours and wages of the worker should be similarly settled, and he has not been free from criticism from the employers' side on that account. We agree with a following speaker that the lecture, of which we give some extracts on another page, should be circulated broadcast, not only among Associations, but among the masses of workers whose

minds are being corrupted by those who either cannot or will not see where they may be leading us by their advocacy of everything for everybody and the Government feeding us all—a popular platform appeal for the have-nots, but one which will secure "nothin' for nobody" but confusion for us all.

The Minimum Charge.

The announcement in the Press on October 31st regarding the Coal Controller's suggestion—that the quarterly minimum charge be modified into an annual charge—brings this vexed question to a definite issue. It was stated in the Press that the proposal had been arranged with the electrical undertakings, but the agreement suggested was more anticipatory than actual, since many of the leading undertakings learnt of the matter only by reading the notice in the paper, and have not, in fact, as yet determined on a line of action. The question of the minimum charge is undoubtedly a difficult one, since theoretically it is entirely justified as ensuring to the undertakings a proper return for their capital outlay in connecting the premises and their charges for keeping the supply available; while, on the other hand, the public generally are markedly dissatisfied. This dissatisfaction has been expressed by members in the House. Further, the Board of Trade has been from time to time bombarded with protests from consumers, and the discussion has for a long time been an outstanding topic in the Press. On the other hand, from the undertaking's point of view the minimum charge is the only safeguard against a consumer making the undertaking a mere matter of convenience and not paying his fair share of cost as compared with the average consumer. As a matter of fact, the Board of Trade has so far acceded to pressure as recently to make it a condition when increasing statutory charges (price per unit) under the Electric Lighting Acts, that the minimum charge should be waived. The same condition is being made, we understand, by the Board of Trade when granting relief under the Statutory Undertakings (Temporary Increase of Charges) Act. With regard to the minimum charge itself, this is included in the schedule attached to the Confirmation Acts, and is expressed in terms of units coupled with a lump sum. The number of units is 20, and the sum equals that number of units worked out at the maximum price. For 6d., 7d., and 8d. Orders, therefore, the charges would be 10s., 11s. 8d., and 13s. 4d. The fact that the minimum charge is expressed as a definite sum authorises the undertakings to charge that sum even though they are not charging their maximum price. This, however, is not invariably done, and some undertakings are charging less than the amount authorised. There are also certain undertakings which have adopted a minimum charge only since the outbreak of war, and some, of course, make no minimum charge.

The suggestion by the Coal Controller does not involve a matter of principle, although, taking it in conjunction with the attitude of the Board of Trade in revising maximum prices, the tendency is evident. The present proposal is best considered by dividing it into two parts—first, the alteration from a quarterly charge to an annual charge: and, secondly, the reduction of the total charge to £1 per annum. It is obvious that the times call for some sort of *modus vivendi*, and as the first part of the suggestion would help to get over the trouble, the undertakings might certainly do worse than arrange accordingly; in fact, some undertakings are already, and have been, allowing the alternative in the ordinary course.

As regards the reduction to £1, this is a matter in which each undertaking will have to take the responsibility of individual action. Whether, if the undertaking should refuse to grant this concession, the Board of Trade could issue a compulsory Order under D.O.R.A., is questionable, seeing that it is merely a question of a few shillings being either in the undertaking's pockets or the consumers' pockets, and the order *per se* would work just as smoothly one way as the other. There certainly does not seem to be any direct clause in the Defence of the Realm Act which would authorise such action; but, of course, it is impossible to dogmatise as to what the Government can, or cannot, do under its present very wide powers.

PARTIAL TRANSFORMATION OF DIRECT-CURRENT REDUCER SETS.

By C. L. BROWN, A.M.I.E.E., Lt. R.E.

The following describes the principle of and sets forth calculations for arriving at the most efficient combination of motor and generator for this type of rotary direct-current voltage transformer.

The advantages gained are:—(1) Higher combined efficiency, this being the most important, as will be seen later, yet in many cases the least considered; (2) cheaper initial cost, without impairing strength and stability or increasing the maintenance and depreciation charges. The whole is effected by winding the machines to give the required voltage ratio and making the necessary connections.

In many cases this type of reducer is unknown, not considered, or presumed not "worth while"; the last is totally wrong, as will be seen from the figures put forward below from actual tests; the approximate saving per annum is given.

It is only necessary here to enter into calculations, of an elementary nature, concerning the outputs of the motor and generator, a formula being worked out to meet any case; the designer can then proceed in the usual manner in accordance with ordinary D.C. machine design.

The principle, as many readers may already know, is to utilise the current which passes through the motor in parallel with the current from the generator which it is driving; this current, as far as the secondary is concerned, is supplied without any transformation losses. Fig. 1 (p. 436) will make the principle clear to those who are not familiar with this plant.

The following are simple methods for arriving at the voltages and outputs of machines; these being direct-coupled, the speeds would be the same, and chosen to suit the designer's standard frames. Let M = motor input current; G = generator output current; V = motor voltage; E = generator voltage (secondary); A = total secondary current in amperes (*i.e.*, generator current plus motor current); e = overall efficiency (this must be an assumed figure, and should, if anything, be on the low side). Given no losses:—

Motor watts = generator watts;

i.e., $M\,V = G\,E$,

$M = G\,E/V$, and $G = M\,V/E$.

Also $(M + G)\,E = E\,A$,

and as $G = M\,V/E$,

we have $(M + M\,V/E)\,E = E\,A$,

$M = E\,A/(1 + V/E)\,E = A/(1 + V/E)$.

Allowing for losses, the voltage ratio V/E would be divided by percentage overall efficiency and multiplied by 100, *i.e.*, $M = A/(1 + e\,V/E)$, this being the only formula necessary.

The generator current is, of course, A − M, hence the actual output of each machine is solved by multiplying the respective current by the respective voltage.

Fig. 2 is a diagram of a P.T. set showing connections of shunt fields, starter, and regulator, the latter being in the generator shunt circuit; there is nothing of particular note. It will be seen that the motor and generator fields when starting are in series, and when running at full speed the contacts "C C" are short-circuited so that each field is connected to its respective side of the mid-wire.

An interesting case is here given of a 160-KW. set, the figures being for about half-load, showing a marked increase in efficiency over an ordinary motor-generator set; the efficiency *increases* over motor-generator sets are more marked in smaller sets.

Output (secondary)	80 KW. at 205 volts.
Primary volts (or line) ...	400 volts.
Secondary volts (or generator) ...	205 volts.
Efficiency (overall)	91 per cent. = total secondary power/total input from line.
Speed of set	1,210 R.P.M.
Mid-wire current	390 amperes.
Windings	Both machines shunt-wound, with commutation poles.

In addition to a saving in cost of something like £125 in capital outlay for the above set, there would be a considerable annual saving, as follows :—

A well-designed motor-generator set under the above conditions would have an efficiency of about 81 per cent.; assuming that the above is required to run at a load factor of, say, 50 per cent. for 10 hours per day, six days per week, with energy at 1d. per B.O.T. unit, there would be a net saving of £140 per annum, which, at the nominal interest of 5 per cent., represents a further capital of £2,800, and higher in proportion to the load factor.

There is no difficulty in running these sets under almost any conditions; they are satisfactory for parallel running with compound-wound generators, in which case the generator

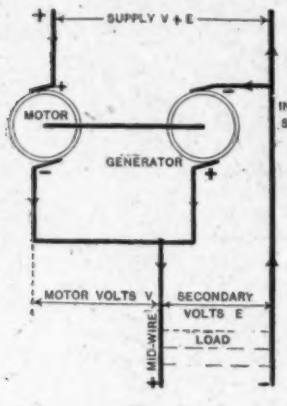


Fig. 1.

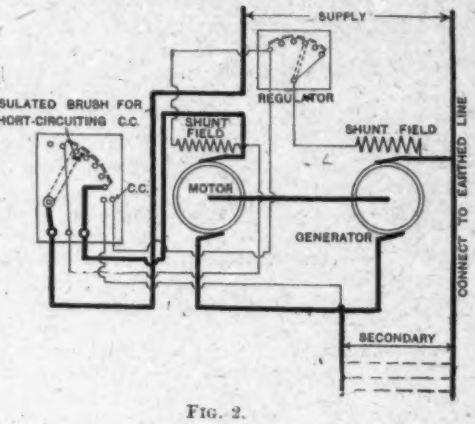


Fig. 2.

of the P.T. set should be also compound-wound, in order that the load fluctuations may be equally shared, *i.e.*, the field characteristics should be the same.

It will be noted that in the case of large voltage ratios in smaller sets up to 15-20 kw.—*i.e.*, where the motor voltage would be about six times that of the generator—not much advantage would be gained over motor-generator sets, on account of the small motor current, on which the increased efficiency depends.

These sets have been successfully used even for kinematograph work, and it would be well to note that care should be taken where the supply system is "earthed" to connect the generator side to the "earthed" line (see fig. 2), otherwise the operator would be in danger of receiving a "shock" of line voltage to "earth."

Note.—As the over-all efficiencies increase as the motor volts decrease, it will readily be seen that these sets are particularly adapted to high secondary voltages and high line voltages.

ELECTRIC TRACTION ON THE CENTRAL ARGENTINE RAILWAY.

(*Concluded from page* 413.)

The electrical equipment of the track comprised the bonding of the track rails, the erection, bonding and protection of the conductor rails, the laying of interconnecting cables across gaps in the conductor rail, and the provision of switchgear for dividing up the track into short electrical sections.

The conductor rail is of the North-Eastern Steel Co.'s high-conductivity steel, weighing 86 lb. per yard. The composition of the rail is as follows: Carbon, 0·03 per cent.; silicon, nil; sulphur, 0·05 per cent.; phosphorus, 0·06 per cent.; and manganese, 0·36 per cent. The electrical resistance of the rail is 6·7 times that of copper of equal volume. The insulators are Doulton's single-shed round-porcelain type, with caps and clips of malleable cast-iron. The rail bonds are of the British Insulated and Helsby Cables' solid-head and pin types, of ·166 sq. in. area. The bond tester is of the Evershed and Vignoles type. The anchorages consist of the British Insulated and Helsby Cables' composition insulators with shackles, plates, and clamps; and the sectioning gear is of the British Thomson-Houston Co.'s 800-volt remote-operated type.

In connection with the electrification scheme, a number of works were carried out which represent important betterments of the track. Thus the whole of the route has been fenced with wire netting. On a length of about a mile near Tigre, which was frequently flooded, the track has been raised above flood level. There are 75 level crossings on the route, and in order to prevent people and animals from straying on the line at these places, special "cattle guards" were installed. A cattle guard consists of a trench dug across the tracks parallel to the road, with brick retaining walls and concrete invert. The depth varies, the standard being about 7 ft.; the width is 6 ft. 6 in. The track rails are carried across on wooden beams, having the upper corners chamfered off to reduce the foothold. The fences are carried up to the trench, and a footway with a locked gate is provided for the use of the maintenance gangs (fig. 15.) Other incidental improvements were the provision under every rail of four sleepers of extra length carrying the insulators, and the installation of new track fishplates.

The track rails are used throughout for the return circuit of the traction current. They weigh 85 lb. per yard, and are part 40 ft. and part 33 ft. long. The joints are bonded with two copper bonds of the ribbon type, with solid heads, giving a total cross-section of $\frac{1}{3}$ sq. in. of copper, and making the ratio of conductivities of 6 ft. of rail, including and excluding a bonded joint, about 3 to 5. To reduce the risk of loss by theft, the bonds are fixed under the fishplates. The two rails of each track are cross-connected every 100 yards with stranded copper bonds carried in wooden troughs fixed to

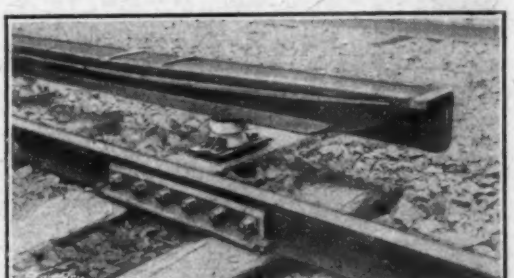


Fig. 13.—Conductor-Rail Ramp.

the sleepers. Adjacent tracks are cross-bonded every 100 yards.

In the Retiro terminus the rails are used for track-circuiting with alternating current. To permit of using

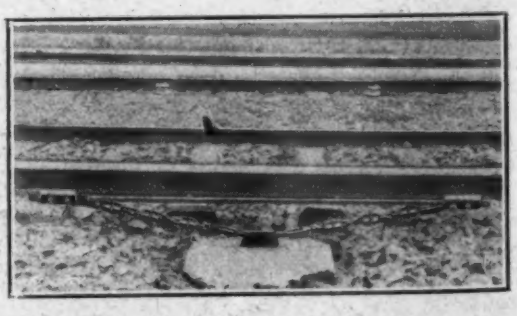


Fig. 14.—Conductor-Rail Anchor.

the same rails as a path for the traction current, impedance bonds are placed at the ends of the track-circuiting sections, these bonds consisting of heavy choke coils contained

in oil-filled cast-iron cases, which are placed between the sleepers. Where crossings occur, only one rail of each track is used for the traction current.

Trespassing on the railway tracks is much more prevalent in the Argentine than in this country, so that any form of conductor rail adopted must be particularly well protected against the risk of people touching it. It was felt that the common form of flat-bottomed rail with side boards attached to it was too much exposed on the top to be safely used, and it was not possible to provide a top cover or adopt the American type of under-running rail, on account of the limited space available between the structure and load gauges. The form of rail shown in fig. 11, p. 412, was ultimately selected as occupying the minimum space consistent with proper clearance, and as permitting of a very complete insulating covering. The rail was rolled without difficulty of high-conducting steel, and can be handled without any tendency to distortion. Before leaving the works, the rails were dipped in hot bitumastic solution to prevent rusting; when the service started up a special skate with scraping edges was fixed to the collector shoe gear on a coach which was hauled up and down by a steam locomotive till the contact surface of the rail was clean; hand scrapers were also used.

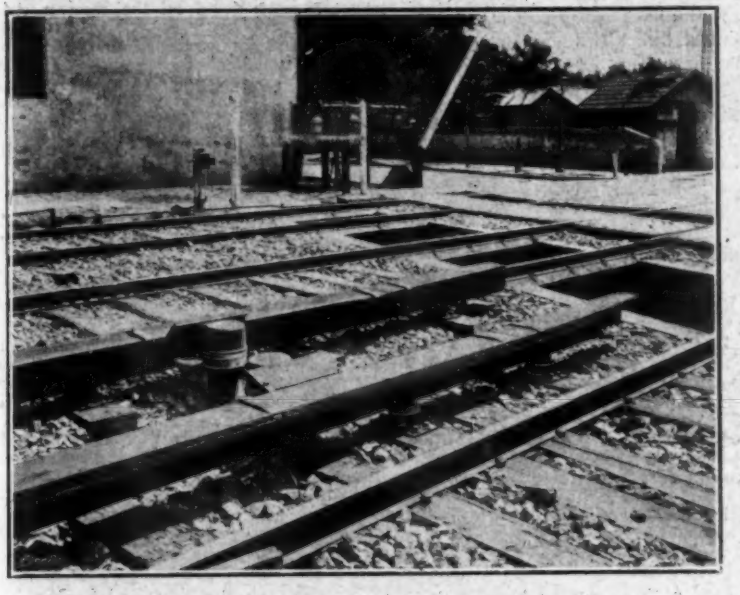


Fig. 15.—Level Crossing with Cattle Guard.

The fishplates are single and are applied to the back of the rail, the bolt heads being countersunk to leave a free passage for the toe of the skate. Two bonds with solid plug heads are fixed under the fishplate, giving a cross section of .38 sq. in. of copper at each joint.

Where gaps occur the rails finish off with cast-steel ramps 5 ft. long, shaped to guide the skate into position without jarring (fig. 13).

The rails and ramps are covered with a protection of creosoted wood boards, built up in the shops, and fixed in position on the ground by hammering over the ends of steel strips to embrace the edges of the top table and foot of the rail. The protection has proved very efficient, no cases of fatal injury from shock having occurred up to the present, though barefooted boys have been seen to run about over the rail and men have used it as a barrow track.

The rail is carried on malleable iron castings cemented into porcelain insulators, which stand on the ends of specially long sleepers, and are fixed to them by malleable iron clips. The insulation of the rail is very good, the usual weekly figure for leakage from the 50 miles erected being between 1·0 and 1·5 amperes.

To prevent creepage every length of conductor rail is anchored, and no length exceeds ½ mile. The anchors used on long lengths consist of insulated links attached to a plate either fixed in a block of concrete or fastened down to a sleeper (fig. 14).

When a conductor rail continuity cable crosses under the track, it is carried in a cast-iron trough bolted to an old sleeper. At cattle guards the cables are carried in iron troughs supported by old rails.

All positive cables finish in terminal pillars (fig. 15), consisting of cast-iron bends into which a fibre sleeve is slipped, the cable being threaded through and the core being sweated into a gunmetal cap resting on a porcelain insulator fitted into the top of the bend. The cap has bolted to it a terminal plate with sockets for stranded bonds which make connection with the conductor rail. The cap and terminal are surrounded by a pot-ware cover, which prevents a person walking past from coming accidentally in contact with live metal.

The conductor rail is so divided into sections by switches mounted in signal cabins, that the signalman can quickly isolate any faulty section, leaving the rest of the system unaffected. The sections are also so arranged that in case of, say, a derailment at one place, any route which would be available for steam-propelled trains is also available for the electric trains. Provision is made for paralleling the "up" and "down" conductor rails, in order to make full use of their combined conductance. A view of a cabin sectioning board is given in fig. 16. The sectioning switches are normally of the 1,000-ampere quick-break knife type; interconnecting switches and those feeding the tracks in Retiro terminus are automatic circuit-breakers. Emergency switches are provided at the crossovers at wayside stations, to allow of trains discharging passengers and setting back to the other line when a fault occurs beyond the platform in a section containing several stations. Sidings and the platform lines at Retiro are controlled by switches mounted in cast-iron boxes, with a danger signal showing when the switch is closed.

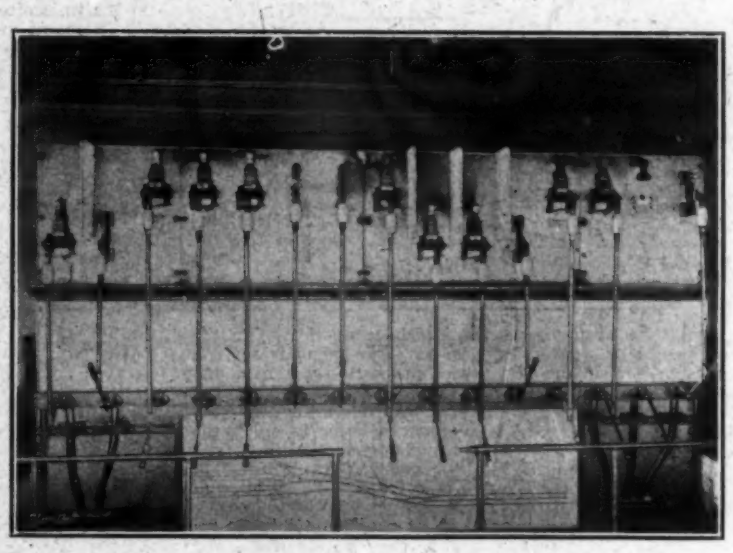


Fig. 16.—Sectioning Board in Signal Cabin.

D

In the first 12 months the mileages run were :—Motor coach miles, 1,782,000 ; trailer coach miles, 1,353,000.

The total number of times the supply to the conductor rail was interrupted was :—Under one minute, 66 ; over one minute, 42.

The total number of trains run was 41,706, and the total amount by which all trains were late arriving at the termini was 817 minutes. The percentage of trains arriving late was 0·213 per cent., of which 0·129 per cent. were over five minutes late. These figures include delays to trains caused by late running of other trains.

As may be judged from these figures, the initial difficulties and maintenance troubles have been few and of minor importance, and the whole system is giving results commensurate with the care devoted to the design, manufacture, and erection of the plant.

AN OSCILLOGRAPHIC STUDY OF A HOWLER SET.*

By LINDLEY PYLE.

THE need of a simple device yielding sustained high-frequency oscillations of the order of 1,000 cycles per second led the author to an oscillographic study of the performance of the so-called "howler" apparatus, the action of which is illustrated by the shrill note emitted when the receiver of a telephone circuit is presented to the mouthpiece of the transmitter.

A telephone transmitter, T (fig. 1), capable of continuous operation at one-half ampere under an applied potential difference of 12 volts, was placed in series with eight fresh dry cells and a fixed non-inductive resistance, *r*, of one ohm, the resulting current traversing the primary of a small induction coil whose vibrator was closed and blocked from action. An ammeter, A, and key, *k*, were usually included in the circuit. A head-type telephone receiver, R, of 1,000 ohms resistance was connected to the secondary of the induction coil, the resistance of the secondary being 1,000 ohms. When the mouth-piece of the transmitter was brought close to the diaphragm of the receiver, a musical note was emitted

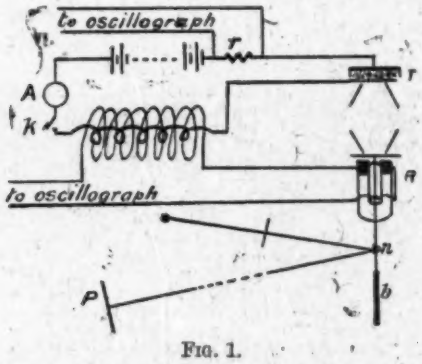


FIG. 1.

by the latter upon closing the key *k* or upon tapping the instrument if *k* were already closed. The pitch of the note is dependent upon the nearness of the mutually excited diaphragms, upon the resistance of the receiver circuit, and upon the way in which the receiver happens to be connected initially to the secondary terminals. In order to study the motion of the receiver diaphragm, use was made of the device termed by D. C. Miller, the "phonodeik," as described in his book on "The Science of Musical Sounds." A piece of thin silk thread was attached by sealing wax to the centre of the rear face of the diaphragm, the other end being led out through a hole in the rear of the receiver case. The thread was then wrapped around a fine needle mounted to rotate freely with its axis parallel to the face of the diaphragm (see *n*, fig. 1). The thread was then tied to a rubber band, *b*, which in turn was attached to a fixed point. A beam of light from a pin-hole impinged upon a minute mirror attached to the needle and was focused upon a photographic plate, P, which could be moved rapidly across the beam of light in a direction parallel to the axis of the needle. Development of the plate yielded an oscillogram of the mechanical vibrations of the diaphragm of the receiver. It was computed from observed data that the extreme displacement of the diaphragm was of the order of 0.01 millimetre. A Duddell oscillograph was used to study the variable currents in the receiver and transmitter circuits. Fig. 1 makes plain how the oscillograph was connected in circuit.

Fig. 2 is an oscillogram of the high-frequency alternating current in the receiver circuit. On the same film a simultaneous record was taken of a 57-cycle per sec. alternating current delivered by the local power house. The higher frequency was found to be 1,270 per sec. The line of zero current does not extend through the centre of the current trace. The maximum current values in one direction exceed the maximum current values in the other direction by approximately 25 per cent. of the arithmetical mean of the maxima, this being characteristic of all the receiver circuit records.

Fig. 3 is the corresponding oscillogram of the vibrations of the receiver diaphragm. The zero line corresponding to the

FIG. 2. FIG. 3.

position of the undisturbed diaphragm is markedly displaced from the centre of the oscillation record. In fact, the diaphragm in action swings *eight* times further *from* the attracting magnet than it swings *towards* it. This is not due to lost motion in the phonodik system, for the zero mark is in the same position after taking a record as before. Fig. 4 shows a not infrequent type of oscillation where there is a regularly alternating variation in height of one set of maxima. Fig. 5 shows the simultaneous behaviour of the receiver diaphragm.

It was thought worth while to study the variation in the primary, or transmitter, circuit. Accordingly, the Duddell instrument was connected to the terminals of the non-inductive resistance (fig. 1) in order to obtain an oscillogram showing the nature of the current traversing the transmitter.

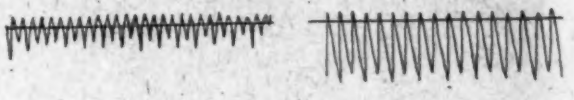


FIG. 4. FIG. 5.

Fig. 6 shows a careful copy of the very faint film record obtained. A projection lantern was used to throw an image of the film upon a sheet of white drawing paper. The lines of the image were traced in pencil and were then photographed to give the published figure. The striking feature is the wide range of fluctuation in the unidirectional current in the transmitter circuit. The current as read on a Weston direct-current ammeter was 0.50 ampere. As reckoned from the line of zero current the minimum values of the current are approximately 8 per cent. of the maximum values.

The "howler" apparatus used in these experiments will give a sustained high-frequency current of the order of 1,200 cycles per second, with no erratic variation in frequency after once set in operation. The operation has been maintained for half an hour with no personal attention whatever. The high frequency current of course departs widely from a sinusoidal form. The piercing note emitted by the diaphragm of the receiver is the only annoying feature about the device. The action continues even with as much as 80,000 ohms in the receiver circuit. The human body itself may be introduced into the receiver circuit without painful physiological effects. The effective current strength (as measured on a Rowland electrodynamometer) in the receiver circuit when no auxiliary resistance is present is about 5 milli-amperes; there is then present 2,000 ohms resistance and considerable inductance. For effective operation it is necessary to keep the primary circuit of low resistance in order that variations in the resistance of the carbon granules of the transmitter may be a high percentage of the total resistance of the circuit. Trial should be made to determine how the terminals of the secondary should be connected to the receiver. The oscillations will be set up with greater ease in one case than when the terminals are reversed. When the transmitter circuit is closed the sound wave thrown from the excited receiver diaphragm against the transmitter diaphragm may be such as to decelerate the motion of the latter rather than accelerate it. The device should be useful as a generator of high-frequency currents where sinusoidal currents are not demanded.

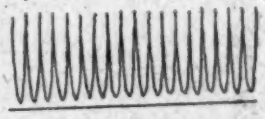


FIG. 6.

* Reprinted from *Washington University Studies*, Vol. 6, Scientific Series No. 1, 1918.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Record Internal-Combustion Engine.

These engines, made by the Record Engineering Co., Ltd., of Eccles, Manchester, have been on the market for some years, but only recently have they come into prominent notice. The engines are designed on similar lines, and may be very well compared with the well-known high-speed self-lubricating steam engine. All the usual two-to-one gears, with their camshafts, cams, tappets, and poppet valves—as used in connection with the ordinary four-stroke cycle engine—have been eliminated. Consequently, this engine simply consists of the usual pistons with rings, and generally speaking, one simple piston valve for every two cylinders, this piston valve being driven by means of an eccentric formed with or fixed directly on to the crankshaft. This constitutes the whole of the valve mechanism, and as this valve only controls the distribution of the gaseous fuel to the pump cylinders, it is only subject to a few pounds pressure per

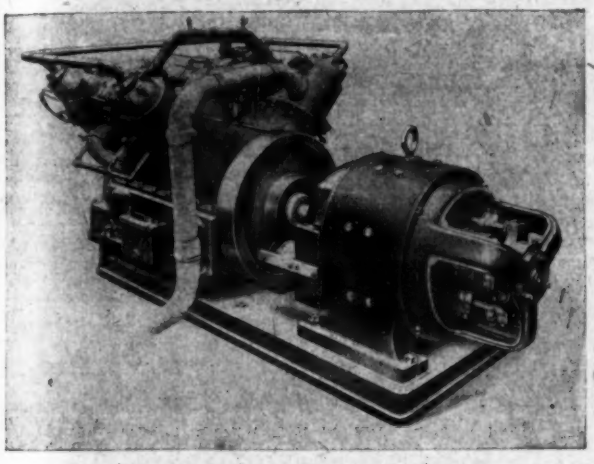


Fig. 1.—"Record" 50-b.h.p. Engine.

square inch, never to the heat of fire, and consequent carbonisation, &c., of the working cylinders.

It will readily be seen that these engines, being of such simple construction, should be capable of maintaining their efficiency over very long periods. They are easy to overhaul and repair, and can be placed in the hands of unskilled labour for supervision. Attendants who have had long experience in the running of steam engines will find they closely approach the plant they have been accustomed to. It is, therefore, the type of engine which will appeal particularly to marine engineers.

In the "Record" engine, many causes of trouble are removed by the crank case being used only as a reservoir for lubricating oil as in the ordinary 4-cycle engine; in reality it works under more favourable conditions owing to the fact that the lubricating oil is not splashed directly on to the inside of the working pistons.

The company recently completed a six-days' endurance test on paraffin, on a 50-b.h.p. engine which was on order for a Government department, and one of the conditions under which the order was placed was that it should run continuously, at full load, on paraffin, without any attention or adjustment whatsoever. The conditions were accepted by the company, and the trial was carried out under the direct supervision of five Government departments which were interested.

During the whole of the trial, the engine received no attention except the usual filling up of fuel tanks and the addition of lubricating oil. No plugs were changed, and when afterwards dismantled, the engine showed no appreciable wear and the cylinders were practically free from deposit. The result of this test shows that a 2-stroke engine can be designed and built to give equal results in economy, efficiency, and endurance, to a 4-stroke engine, with the added advantage of great simplicity. The engine recently tested was of the "V" type, four-cylinder design, with two cranks giving four impulses per revolution, making the turning very even, and owing to the absence of valves and valve gear, the engine runs silently under all conditions of load, and absolutely free from vibration.

Fig. 1 shows the 50-b.h.p. engine referred to, whilst fig. 2 illustrates the standard 5-kw. petrol generating set with radiator system of cooling.

Generally speaking, the engines are substantially designed as regards the working parts, and ample provision is made for wear, while large doors are provided in the crank case to enable adjustments to be made without dismantling. It will also be seen from the illustrations that the cylinder heads are made loose, consequently both piston tops and combustion chambers can be cleaned without dismantling the parts.

The London office of the company is: Donnington House, Norfolk Street, Strand, W.C. 2.

Electrical Starting Apparatus for Petrol Motors.

Mr. Harry Lucas and Mr. C. L. Breeden, of Joseph Lucas, Ltd., Birmingham, have recently taken out patents in respect of two forms of electrically-actuated pinion and toothed-ring meshing arrangements which are worthy of

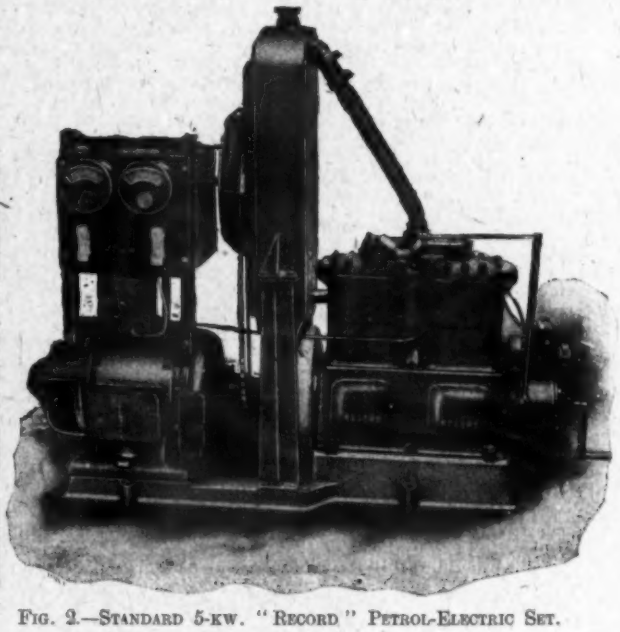
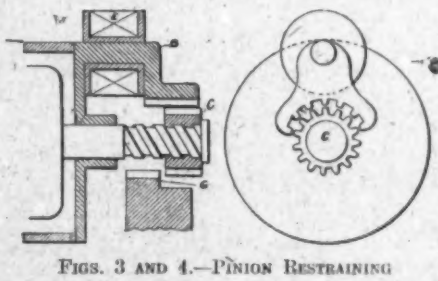


Fig. 2.—Standard 5-kw. "Record" Petrol-Electric Set.

notice. The first arrangement comprises a means of imposing on the pinion a magnetic force adapted to restrain rotation in the pinion during the meshing operation, the necessary magnetic force being obtained by a magnetic pole piece adjacent to the pinion teeth and a winding for its excitation. From the accompanying diagrammatic sectional side and end views, figs. 3 and 4, it will be seen that the end cover of the motor is made of magnetic material and provided with a pole piece B situated over the driving pinion, the extension of the pole piece being connected to a core carrying an exciting coil E. The inner surface of the forward end of the pole piece is made to a tooth-like configuration, similar to that of the driving pinion C, the two being closely set to, but not touching, one another. The circuit for the magnetic flux starting from the core is across the pole piece radially through both sets of teeth and back along the screwed shaft of the pinion and end cover. Due to the concentration of the flux on the teeth, any tendency of the pinion to rotate with the shaft when the latter is started is resisted, and rotation of



Figs. 3 and 4.—Pinion Restraining Arrangement for Electric Starters.

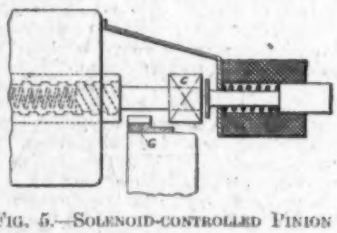


Fig. 5.—Solenoid-controlled Pinion of Electric Starter.

the shaft results in a screwing of the pinion into mesh with the driven toothed ring G. It is pointed out that the resistance to rotation is not in the nature of a positive lock, and consequently when the pinion meshes it can rotate against the action of the magnetic flux. After proper meshing of the pinion, the current through the coil is cut off and a full current passed to the motor, enabling the full turning effort to be exerted. Suitable provision is made in the coil circuit so that after the

engine has been started the coil does not come into action during the disengagement of the pinion; the latter is therefore free to come away from the toothed ring without restraint. It is claimed that by this arrangement the meshing operation can be effected with a slow rotation of the motor, the full power not being exerted until meshing is complete.

The second Lucas arrangement, shown diagramatically in fig. 5 comprises the combination of a pinion screw connected with the armature shaft, and a solenoid adapted to produce axial movement of the pinion relative to the shaft. The armature shaft proper is hollow and screwed internally; an externally-screwed shaft carrying the driving pinion c engages the same, the angle of the screw being such that the pinion can be moved axially by an endwise pressure. In conjunction with the pinion is a co-axially-arranged plunger of a solenoid carried on a bracket mounted on one end of the motor casing. On closing the starting switch the solenoid is excited, and its plunger causes the pinion to traverse along the armature shaft, the latter being concurrently slowly rotated. When the pinion becomes meshed with the teeth c on the engine flywheel, a further switch operation puts the solenoid out of action and passes full current to the motor. The switch control arrangement is such that the solenoid remains out of action and does not interfere with the return of the pinion by the flywheel teeth after the engine has been started. Further, the solenoid does not again come into action during the opening of the switch, so that the pinion is unaffected after the engine has been started. The solenoid plunger is returned by a spring when the solenoid is de-energised, while a spring may, as shown, be arranged in the hollow armature shaft as a buffer.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Economy in the Use of Electric Lamps.

In view of the great attention that is being paid to economy in the use of coal, and the emphasis this places on the use of the most efficient lamps, it is interesting to review the present relative economy and cost of electric lamps in the 200—250-volt range as compared to the 100—130-volt range.

It will be recalled that years ago the 200—250-volt-pressure was adopted for electric light and power distribution in Great Britain without regard to the resultant loss in lamp efficiency and increased cost of electric lamps. The following tables show the present status of electric-lamp efficiency in the high and low-voltage ranges and the difference in cost. Table I shows the conditions for the United States and Table II the conditions for Great Britain. The relative greater percentage-gain in efficiency for U.S.A. in 100-volt over 200-volt lamps is due to the greater attention paid to advancing the efficiency of 100-volt lamps in the United States.

On the average, the adoption of the higher voltage, 200—250 volts, sacrifices 10 per cent. in lamp efficiency and electric lighting service, as compared to the 100—125-volt service.

TABLE I.—ELECTRIC LAMP COMPARISON FOR THE UNITED STATES.

Size of lamp (watts).	Vacuum type.			Gas-filled type.					
	25.	50.	100.	200.	300.	400.	500.	750.	1,000.
Light output (lumens), 110 volts	230	476	1,010	2,220	4,850	6,150	8,050	12,800	18,000
Light output (lumens), 220 volts	190	422	900	2,520	4,180	5,850	7,400	11,550	16,100
Extra light output in favour of 110-volt lamp	21%	13%	12%	16%	18%	5%	9%	11%	12%
List price of lamp, 110-volt	$0·30	$0·30	$0·70	$2·20	$3·25	$4·30	$4·70	$6·50	$7·50
ditto 220-volt	0·35	0·35	0·85	2·40	3·90	5·10	5·60	7·70	9·00
Difference in list price in favour of 110-volt lamp	14·3%	14·3%	17·6%	8·3%	16·6%	15·7%	16%	15·6%	16·7%

TABLE II.—ELECTRIC LAMP COMPARISON FOR GREAT BRITAIN.

Size of lamps (watts).	Vacuum type.			Half-watt type.				
	30.	60.	100.	200.	300.	500.	1,000.	1,500.
Light output (lumens), 110-volt	255	535	930	2,800	4,600	8,500	18,000	28,000
ditto 220-volt	229	515	905	2,500	4,200	7,900	16,500	26,000
Extra light output in favour of 110-volt lamp	11%	4%	3%	12%	10%	10%	9%	8%
List price of 110-volt lamp	3/-	3/-	6/-	20/-	25/-	30/-	40/-	50/-
ditto 220-volt lamp	3/6	3/6	6/-	20/-	30/-	30/-	40/-	60/-
Difference in list price in favour of 110-volt lamp	14·3%	14·3%	nil	nil	16·6%	nil	nil	nil

London, E.C., *October 14th*, 1918. F. W. Willcox.

Work Without Pay.

The letter of "District Engineer," appearing in your issue of the 1st inst., will meet with the approval of all who have knowledge of the amount of work involved in carrying out the duties attached to the appointment of district engineer under the B.O.T. coal economy scheme. It is to be hoped, however, that chief engineers so appointed will not forget that in consequence of the additional work voluntarily undertaken by them in this connection, it has been necessary to allocate more of their regular duties and responsibilities to members of their staffs, and that for this and other reasons, they will view with greater sympathy than many appear to intend doing the request recently made by the Council of the E.P.E.A. for more adequate remuneration of their technical staff members. From personal knowledge I am able to state that it is the intention of more than one chief engineer to treat the request of the E.P.E.A. with contempt, and, in one case, the request was characterised as being "absolutely ridiculous" by a chief engineer who, since the commencement of the war, has had his salary increased by at least 60 per cent.

Technical Assistant.

November 2nd, 1918.

Referring to the anonymous letter subscribed "District Engineer" in your current issue, I am of opinion that the person responsible for it should furnish his name; as, in view of the distinct understanding between the Coal Mines Department and district engineers, and the uniformly courteous and sympathetic way in which the heads of the Department have met their "voluntary" assistants, an indication of dissatisfaction of this nature, which I feel quite sure is almost unique amongst the 400, casts an unmerited slur on the majority.

E. Holcombe Hewlett,
Borough Electrical Engineer.

Mansfield, *November 2nd*, 1918.

Although in complete agreement with the views of "District Engineer," I would respectfully point out to him that he knew on what terms his services were to be rendered. In this time of national stress some give their lives, some their services, some see what their country can give them; unfortunately, we see this latter spirit all round us. Do not let us, as a body, foster this.

District Engineer, No. 2.

November 5th, 1918.

Empire Water-Power Developments.

As one who has been employed on E.H.T. and hydro-electric schemes in responsible positions in South Africa, Western India, and Afghanistan, I have met far cleverer electrical engineers of my own nationality than any that Germany sent abroad, and have great pleasure in endorsing "British Engineer's" statement.

Hydro-Electric.

November 2nd, 1918.

"Fraternity"—or Tyranny?

We have read with amazement the controversy in the pages of the ELECTRICAL REVIEW between the E.T.U. and E.P.E.A., and we think it detrimental to the interests of both societies.

Would it not be more beneficial for these two societies to have a better understanding and work more in harmony one with the other?

The more bitter feelings that exists the better will the interest of those in higher authority be served; and as the writers of this letter are one a member of the E.T.U. and the other of the E.P.E.A., we feel sure that some arrangement and a satisfactory settlement could be brought about, and we suggest, seeing that unity is strength, the sooner the better for the benefit of all that a meeting of the two societies should take place, when all petty squabbles could be settled. We feel sure that these bitter feelings and controversies are not appreciated by members of either society, and we hope that in the near future the E.T.U. and E.P.E.A. will work hand in hand for the betterment of the employés of electrical undertakings.

Unity.

October 29th, 1918.

Training Disabled Men.—A report submitted to the Leeds Education Committee, on the courses of training established at the Leeds Central Technical School for disabled soldiers and sailors, shows that there are classes of 30 students in electrical work, ten in kinema operating, three in Morse telegraphy, nine in mechanical engineering, and four in oxy-acetylene welding. The courses are full-time day courses, occupying about 30 hours per week. They are conducted under the auspices of the various trade advisory Committees under the Ministries of Pensions and Labour. In addition to the special courses for disabled fighters, such men are admitted to courses in engineering (fitting, turning, a machine operating) not specially organised for them. Two men is allowed to become proficient in oxy-acetylene welding, three months for kinema operating, telegraphy, and mechan engineering.

WAR ITEMS.

Soldiers' Letters.—Staff-Sergeant, R.E., writing "In the Field," under date October 27th, says:—"Again I wish to thank you for the inestimable privilege of receiving your weekly publication, which, especially in the 'wilds' here, is much appreciated."

The Demobilisation of Machinery.—A member of the House of Commons, on Tuesday, asked the Minister of Reconstruction what was going to be done in the way of demobilising the vast quantity of Government machinery—agricultural and other.

American Exporters Discuss Peace Trade.—The American Manufacturers' Export Association held a dinner in New York a few days ago to discuss post-war problems.

Trading with the Enemy.—The "London Gazette" for November 1st contains further lists of bodies and persons in the following countries with whom trading is prohibited:—Uruguay; Brazil; Chile; Guatemala; Honduras; Mexico; Morocco; Netherlands; Netherlands East Indies; Panama; Peru; Spain; Sweden; and Venezuela.

Post-War Trade Policy.—The final report of Lord Balfour of Burleigh's Committee on Industrial Policy After the War was discussed at the quarterly meeting of the Association of Chambers of Commerce. Resolutions were passed that it is essential for the purpose of making preparations for post-war industries that an immediate pronouncement should be made by the Government concerning the question of trade within the Empire with Allied countries, neutrals, and enemies; that the suggested prohibition for twelve months on the importation of goods of enemy origin is not sufficient, and should be much extended, and that the conditions should be extremely drastic.

It was decided to ask the President of the Board of Trade to receive a deputation to urge upon him that steps should be taken without delay to introduce legislation to prevent or restrict after the war the dumping of foreign goods into the United Kingdom at a lower invoice price than would be charged in the home market of the producing country; that such legislation should be framed on the principle of similar legislation which has been in operation in Canada for some years, and should provide, at least, for an additional Customs duty equal to the difference between the invoice price for export and the fair home market value.—*Morning Post.*

Reconstruction.—As a first step towards co-ordinating or pooling the efforts of the several organisations which for some time past have been engaged in reconstruction propaganda, the Industrial Reconstruction Council and the Reconstruction Society have formed a joint committee, and planned a national campaign on the lines of their recent work.

According to the *Times*, the National Alliance of Employers and Employed has lately made considerable progress with its movement for bringing employers and employed together. The labour organiser has held successful meetings of delegates from trades and labour councils in the Midlands, including Stafford, Wolverhampton, Dudley, Wellington, Cannock, and Shrewsbury. Lieut.-General Sir Edward Bethune and Mr. Harry Dubery, on Thursday last week, completed the formation of a joint committee of employers and employed in Liverpool, and on the same day Mr. W. A. Appleton and Mr. T. Ernest Jackson addressed a sympathetic audience comprising 300 delegates of the allied engineering trades at Keighley. Similar conferences are being held at Leeds, Doncaster, and other important industrial centres.

The A.E.G. to pay 14 per cent. Dividend.—The directors of the A.E.G. of Berlin estimate that the company will be able to pay 14 per cent. for 1917-18, as compared with 12 per cent. in the preceding year.

Without Permission.—At Salford, on Friday, the London Electric Wire Co. and Frederick Smith, Ltd., wire manufacturers, and Mr. A. J. Hanson, the works manager, were summoned for breaches of the priority order of the Ministry of Munitions. Sir Wm. Cobbett, for the prosecution, said the defendants used lead in the making of conveniences for workpeople, without the necessary permission of the Ministry of Munitions. It was quite possible that the permit would have been granted, if application had been made, but it was done without permission. For the defendants, it was stated that the work was necessary, and that they knew nothing of the extra lead being used. They were engaged on important Government work. The Stipendiary held that the law had been broken, and imposed a fine of £1 on each of four summonses, with £5 5s. costs.

Munition Works and Peace.—In the expectation that the war will be ended very shortly many men, particularly in the engineering trades, who left their employment to go into munition works, are now endeavouring to return to their old trades. A considerable number of men made representations during the last few days to their old firm that they felt they could now be released from Government work, and would be willing to resume their former employment. Another point to be remembered is the accumulation of stocks. It may be that contracts which are now terminating will not be so freely renewed until stocks have been somewhat depleted, and we are informed that this applies to a certain extent to the production of component parts. Instances are mentioned in which the smaller firms engaged in this work have been told that they must prepare to return, on the completion of contracts, to their private business, so that they may not be unemployed when their munition contracts are not renewed. In some directions steps are undoubtedly being taken to transform plant for the manufacture of new models and peace-time products. Possibly it is a combination of these circumstances that has led to the prevalent rumours of considerable dismissals.—*Birmingham Post.*

One result of the collapse of all our enemies except Germany is the shutting down of the manufactures of munitions of war material, enough of which is already in hand for more than a year's fierce war against all our enemies. This brings us right up against the problem of employment and the productive use of the vast quantity of machines and other appliances up to the present used exclusively for turning out war material. It is the plain duty of every patriotic man and woman whether in or temporarily out of employment to keep a steady head and a quiet tongue, in order that our country may right itself and turn from the greatest war factory in history to what it ought to be, and will be, if we all pull together, the greatest centre of industry in the world.—*Evening News.*

The Sheffield correspondent of the *Engineer*, writing on "Peace Preparations," says:—

"Next to munitions output, the chief matter of interest in this district continues to be the preparation for a return to peace conditions. One may observe it on all hands. And these plans would be a great deal more conspicuous even than they are if only labour and materials were available for building operations. When hostilities cease and the interregnum period has been lived through, there should be an enormous trade boom here, and it is for this that the leading firms are putting their works into a condition of readiness. What a transformed Sheffield the return of peace will find! If one could only close one's eyes to that awful wastage of war in precious lives, and in material and financial resources, it would have to be admitted that the last four years have done more for Sheffield's industries than would otherwise have been likely for very many decades. From one end of the eastern district to the other there is scarcely an inch of ground not already built upon, being built upon, or earmarked for building upon as soon as circumstances will allow. The open country between Sheffield and Rotherham has now been spanned by steel works. The two areas are as one, and the day is almost within sight when the remaining interstices will all be filled up with works sites. The most striking features along the road uniting the towns are the large works of Steel, Peech & Tozer, and, in the Tinsley district, the great place being completed by Vickers. What is troubling some of the smaller firms, which have been placed firmly upon their feet by war contracts, is the question of whether, and, if so how, munition-making machinery can be adapted to the manufacture of the requirements of peace. There is a feeling that this is one of those reconstruction problems which some of the Government Departments might assist the firms concerned to solve. It is not quite clear how they could actually help in the matter; but, from all accounts, a national factory, not many miles from Sheffield, has been reorganised, as to plant and machinery, so many times that the impression has been created that the department carrying out those changes might be in an excellent position to impart a few wrinkles in the adaptation of war machinery to peace purposes. There is still a good deal of talk about scrapping much of the present plant, but it is to be hoped ingenuity will come to the rescue with a better and more economical way than that."

A Manchester correspondent of the *Financial Times* writes as follows:—

> In view of the probability of an early peace manufacturers throughout the country who are engaged on war contracts are concerned as to what action will be taken by the Government with regard to orders not completed. It is of interest, therefore, to point out that the "break clause" for War Office contracts says that if at any time during the currency of a contract the present war shall terminate, or there shall be, in the opinion of the Secretary of State for War, a probability of its early termination, the Secretary for War shall be entitled to require the contractor, within 14 days from the receipt of written notice to that effect, to cease manufacture under the contract, and the contractor shall after the expiration of such notice take no further steps towards the completion of the contract, except as may be directed by the Secretary for War. If he shall direct the contractor to complete, in accordance with the contract, all or any articles in course of manufacture, such articles shall be delivered at such periods as may be mutually agreed. If the contractor shall have reasonably performed all his obligations under the contract down to the date of the expiration of such notice, the Secretary for War shall, unless otherwise mutually agreed, take over all articles in course of manufacture which the contractor shall not be directed to complete at a price to be calculated on the basis of the net invoice price of the materials used, the cost of productive labour actually employed on such articles, such establishment charges as the Secretary for War may consider to be reasonable, and an allowance of 5 per cent. on the price of materials, the cost of production, and establishment charges.

In Parliament, on Monday, Mr. George Terrell asked a further question respecting war contracts and peace. He asked whether the Prime Minister was aware of the consequences which were likely to occur to manufacturers on the cessation of hostilities if there was delay in appointing a central authority empowered to wind up, settle and make prompt payments on account of war contracts; and what immediate steps he proposed to take to deal with the matter. The Chancellor of the Exchequer, who replied, said that the Government were fully aware of the possibility referred to in the question, and were taking all possible steps to deal with it.

Westinghouse Feeds the Guns.—In connection with Manchester's Big Gun Week, the British Westinghouse Co., Ltd., Trafford Park, subscribed £100,000 to War Bonds, and the employés of the firm a further £19,752.

Post-War Priority Committee.—Further particulars respecting this Committee and its work appear in our "Notes" to-day.

Armistice and Shipping Insurance Rates.—The Board of Trade last week issued a notice to the effect that in the event of the declaration of an armistice rates of premium upon all insurances accepted on or after November 1st, 1918, would be reduced 50 per cent. in cases where the vessels concerned should sail during the continuance of such armistice.

Canadian Manufacturers and Reconstruction.—The Ottawa correspondent of the *Morning Post* says that on October 29th a conference took place there between representatives of the Dominion Government, of Canadian manufacturers, and of industrial reconstruction committees for the purpose of considering the opening of new fields to industry and the development of export trade. A commission is to be appointed to co-operate with the Government on these questions after the war.

Financial Panic in Germany.—According to a Reuter dispatch from Amsterdam (October 30th) something of a financial panic had broken out in Germany. Rumours of a moratorium, it seems, led numerous circles to draw their balances at credit institutions, and to hoard paper money. It may not be long now before we are able to see of what value will be those enormous reserves that the A.E.G. and other big electrical concerns invested in German War Loan for after-war export and other trade schemes.

Reconstruction Measures.—At the luncheon of the Federation of British Industries last week, speeches on reconstruction were delivered by several Ministers. Dr. Addison said that the first big problem was the liberation and supply of essential raw materials for the restoration of our basic industries. A programme of shipping had been arranged which aimed at bringing over as quickly and as soon as possible any raw materials of which our industries were short. The Ministry of Shipping was quite sanguine as to its ability to provide, at quite short notice, the necessary tonnage. They would free our great industries from control at the earliest possible moment. If we could have an industrial armistice during the transition period there would be an era of great prosperity for British manufacturers. The demands for machinery and for restoration were prodigious, and customers for British goods would be very numerous. The anxious time would be the transition period, and he invited the support of those present for any exceptional measures that might be proposed. They must keep their pledged word to the trade unionists. The future would require a system vastly different from that which had prevailed in the past.

Wages in Germany.—Officially collected statistics regarding the increases in wages in Germany during the war were given in the *Mitteilungen des Kriegsausschusses der deutschen Industrie* for August 17th. They include the pre-war figures and those at September, 1917, for the following industries:—

	Men's daily wages. Mar., 1914. Mk.	Men's daily wages. Sept., 1917. Mk.	Women's daily wages. Mar., 1914. Mk.	Women's daily wages. Sept., 1917. Mk.
Engineering Trade	5.22	10.79	2.28	4.88
Electrical Industry	4.53	10.93	2.75	6.18
Iron and Metal Industry ...	5.05	11.81	2.06	5.67
Paper Industry	3.93	7.37	2.15	4.09
Foodstuffs Industry	5.70	7.51	2.10	3.72
Pottery Industry	4.45	7.07	1.67	2.87

Exemption Applications.—With the assent of the National Service Representative, the Newton Abbot Rural Tribunal has granted exemption to February 1st, unless a substitute is provided in the meantime, to S. J. H. Payne (25, Grade 1), second engineer at the Bovey Tracey Electricity Works.

West Kent Appeal Court has granted three months' exemption to S. A. Bridger (21), a conscientious objector, who is a pattern maker with Messrs. Fraser & Chalmers, electrical engineers, of Erith.

Kendal Tribunal has granted exemption until April 15th to F. Collinge and J. A. T. Barnes, electrical engineers.

Dartford Rural Tribunal has granted six months' exemption to A. Pinson (20), electric tramcar driver, of Northfleet.

At Dover, on October 30th, six months were granted to G. Hopkins (35, Grade 1), stoker at the Municipal Electricity Works, and the Corporation tramways manager (Mr. Bond) appealed for G. F. Howard (36), assistant fitter. The National Service representative objected on the ground that the trams were not being repaired. Mr. Bond said that he was doing what he could; repairs were delayed because he could not get more men. Six months were conceded.

At Watford, on October 30th, R. E. Cawdell, electrician, was given six months' exemption on the ground of being in a certified occupation.

REVIEWS.

The Year Book of Wireless Telegraphy and Telephony, 1918. London: Wireless Press, Ltd. Pp. 1,154. Illustrated. Price 6s. net.

Year by year it becomes more difficult to do justice to this annual within the space limitations of a review. The present issue, paper restrictions notwithstanding, contains 200 odd more pages than were in last year's edition, thanks to which close upon half of the volume is now devoted to the laws and regulations of various countries concerning "wireless" and its use. When peace shall raise the veil of secrecy now hiding the remarkable technical progress of the past few years, there will be a wealth of technical notes to be added to the Year Book—and the latter will become about as portable as the Post Office Directory! Already there are signs of what will have to be done. The section of Useful Data, revised and extended so excellently last year, cannot be developed further in the Year Book, hence the publishers have promised that it shall form the basis of a small separate volume soon to appear. May we suggest that in the near future the Year Book will appear in three parts, viz., a volume of laws and regulations, &c.; a volume of technical articles, records, and reviews; and a small pocket volume of "useful data"?

Turning now to a brief review of the current volume, it must be admitted that the additional space now occupied has been used to excellent advantage, and the volume shows throughout that wholesale revision which has made it so useful year by year. The brief summaries of earlier legislation and present organisation affecting wireless telegraphy in different countries, now included for the first time, enhance the interest and value of the book. The whole-hearted co-operation of leading officials all over the world has made it possible to deal with the laws and regulations in a manner uniquely complete and authoritative. The special index to this section is a valuable feature.

The special technical articles, to which we always turn with such interest, include this year a paper by Dr. J. A. Fleming on Waves in Water, Air, Earth, and Ether (an instructive thesis on fundamental facts and principles); an analytical treatment of the Energy Transmission in Wireless Telegraphy, by Dr. Balth van der Pol (Utrecht); a review of Wireless Telegraphy in the U.S.A. as affected by the war, by D. Sarnoff; a comprehensive treatment of the magnetic behaviour of iron in alternating fields of radio-frequency (Dr. McLachlan); and a spirited "looking ahead," by A. R. Burrows, concerning the "possibilities" of wireless.

The notes on devotion to duty by ships' operators and the records of life-saving at sea are as inspiring as ever, and have a special significance under present conditions. The record of wireless developments has been brought up to date as fully as is permissible during the war, and the same remark applies to the particulars of wireless patents in 1917. Mr. Shoenberg's notes on valve patents published during 1917 are both interesting and valuable. The illustrations throughout are admirable, and of exceptional interest, and hints are given here and elsewhere as to the war service rendered by wireless in general and aero equipment in particular.

Standing features of the Year Book, which need not be again discussed save to say that they have been revised as completely as possible at present, include the lists of land and ship wireless stations and call letters; the large folding map of the world showing wireless stations; the biographical notes, and the lists and directories of companies engaged in commercial development of wireless, literature of wireless telegraphy and telephony, wireless societies, and Lloyds signal stations. Once again we find practically nothing in the volume concerning wireless telephony, but we expect to find a great deal—after the war.

A Small Book on Electric Motors. By W. Perren Maycock, M.I.E.E. Pp. ix + 192; figs. 128. London: Sir Isaac Pitman & Sons, Ltd. Price 5s. net.

A few weeks ago, in an article entitled "Wanted—a Book," we pointed out that the electrical artisan was in need of a simple work explaining the characteristics and uses of A.C. motors in language that he could understand without difficulty; that he did not require instruction on the more technical aspects of the subject—he had no use for sine curves, or anything in the shape of mathematical analysis; and that we were quite sure that the want could be supplied. We did not then know that the late Mr. Maycock, whose prolific pen had done so much to smooth the path of the electrical tyro, had arrived at practically the same conclusion, and had actually written the book which is before us. The author says in his preface: "This book will be of little use to electrical engineering students, except those making their very first acquaintance with the subject, for it is entirely free from technical and mathematical complications. It will be of even less use to the electrical engineer, unless he desires a work for recommending to his non-technical clients. . . . This book is intended to transmit just so much knowledge as will be useful to those who only want to know about ordinary motors and motor control, and who do not desire to dig into technical details. And it should be within the grasp of those possessing little or no electrical information to

start with." Thus he aims to fill the very want that we outlined; it remains to see whether he hits the mark.

The book deals with both D.C. and A.C. motors, and begins with elementary ideas regarding the uses and advantages of the electric motor, the methods of supplying it with power, cables, wiring, &c. Next, the construction of a D.C. motor is explained, showing simply the cause of rotation of the armature, and describing the main features of the complete machine. Brief explanations of the differences between shunt and series motors, the methods of controlling motors, starting resistances, controllers—including, of course, the tumbler switch controls beloved of the author—speed regulation, and the various types of motor casing constitute the remainder of the D.C. section. Alternating currents are approached by way of the choking coil and the auto-transformer, leading up to the transformer proper; here the author evidently met with serious difficulties, as might be expected, and by-passes them as far as possible by making statements as to what happens, without dwelling on the reasons why it happens. We by no means quarrel with him on this score; this course, in fact, is unavoidable if his object is to be attained. One of the earliest subjects discussed in books on dynamics is the acceleration of a body falling under the action of gravitation; but we are not acquainted with any textbook, no matter how advanced, which provides an explanation of the *cause* of gravitation, for the sufficient reason that nobody knows the cause. This fact, however, presents no obstacle to the exhaustive discussion of its effects. In the same way we are taught to calculate the flux produced in a magnetic circuit by a known excitation—but *why* ampere-turns should give rise to magnetic flux remains an unsolved mystery. Until these two phenomena—or at least the latter—are explained, we defy the physicist and the mathematician to cavil at the author's superficial treatment of his subject in this respect.

The construction of a squirrel-cage rotor presents no difficulty, but the action of the stator baffles description, and the author hastily throws out a rear-guard in the shape of a reference to one of his other works, and retreats to the subject of controls for single-phase motors. Wound rotors and their connections, the use of transformers, three-phase motors and controls, starters, &c., are dealt with in turn, and a final chapter provides more detailed explanations of matters which have been lightly passed over in the body of the book, including elementary electrical calculations. It is in this section only, five pages from the end, that we find the sine curves which, in our leaderette, we suggested should be relegated to an appendix.

Now, while we cannot say that this "small book" fully corresponds with our desideratum—for it tells little or nothing about installing motors and similar practical points—it certainly goes a very long way in that direction. Supplemented by a companion volume, or expanded in a second edition, it would probably meet the case, and we only regret that the author's premature decease prevents his completing the work on these lines. We recommend the book to all readers who are unable to dig deeply into the subject, but wish to gain an insight, be it only superficial, into the construction and working of electric motors.

DIESEL ENGINE USERS' ASSOCIATION.

Before the Association on October 24th, Mr. James Richardson, of Messrs. William Beardmore & Co., Ltd., read a paper on "The Semi-Diesel Oil Engine," of which the following is an abstract.

The advantage of high compression, which according to theory resulted in economy in fuel and a higher mean effective pressure per cylinder, was counterbalanced by an advantage of low compression in the more even turning moment and a higher mechanical efficiency.

The semi-Diesel was a variable compression engine, high compression being limited to that at which the compression alone ignited the charge, and the lower to that at which the size of the hot bulb became inconveniently large. From practical considerations there was a point above which it was inadvisable to raise the compression due to losses incurred by piston friction. On that account the mechanical efficiency of the internal combustion engine was low compared with that of the steam engine.

As regards fuel economy the semi-Diesel engine gave very satisfactory results as its cycle of operation was nearer the economical explosion cycle than that of the Diesel engine. In the matter of flexibility, it was really a constant load and constant speed engine. Flexibility could be considered under three headings: (1) constant M.E.P. with varying power and revolutions; (2) constant speed and varying M.E.P.; (3) varying speed and M.E.P.

Condition (1) need not be considered from a practical point of view. After considering the second condition in detail Mr. Richardson pointed out that even where means were provided for throttling the cooling water and scavenging air, a point was quickly reached where the heat of the bulb was insufficient to ignite the charge.

The water drip was used in order to extend the range of working to cover from overload to a small load without recourse to the blow lamp. At full load the water served to take heat from the bulb so that a low compression engine with a fairly large bulb could run at from three-quarters to full load satisfactorily. By cutting off the water, low load could be reached. The water for this purpose should be as pure as possible to prevent deposits. It had a deleterious effect on the lubrication of the internal parts, and was only a crude solution of the problem. The better solution was to vary the point of ignition of the fuel charge to correspond with the load on the engine. Gears had been designed by means of which, in conjunction with the governor, the ignition might be varied according to the amount of fuel admitted to the engine.

In the matter of scavenging the efficiency was lower in the 2-cycle engine than in the 4-cycle, the amount of air available per cylinder being limited to the volume swept by the piston. In addition to this the air drawn into the crank chamber was impregnated with lubricating oil and had a cooling effect on the working parts. Probably the greatest loss in efficiency concerned the scavenging in the cylinder; large exhaust ports, ample passages, and a minimum of restriction in the exhaust ports were a necessity. The subject of stroke to bore ratio was intimately associated with that question, and Mr. Richardson's experience suggested that the larger the stroke to bore ratio, within limits, the less the escape of scavenging air through the exhaust. Turbulence was on a par with scavenging, and had as yet received little attention. With regard to the period of injection, practical considerations determined the period for full-power running to be about 30 degrees. No standard had been fixed for fineness of spray, although this could be too fine. It was essential that the whole of the oil should be in the combustion chamber in the form of a spray before the first particle touched the hot bulb, which argued for a long throw of the fuel although this militated against flexibility.

In the matter of fuel, the outstanding difference between the Diesel and the semi-Diesel had been the small range of fuels with which the latter could cope. Recently experiments had been made in the use of heavier fuel oils more readily obtainable. At present most fuel oils ranging between .8 and .9 in specific gravity could be used. Shale oil had been most frequently used. Heavy oils required pre-heating to facilitate pumping. In that connection the semi-Diesel, being of the "solid injection" type, did not run with as clean an exhaust as the Diesel, and the amount of overhauling of parts required was greater.

As regards lubrication, this was carried out in almost a similar manner to the Diesel engine, the consumption working out at about .02 lb. per B.H.P.-hr. The engine was started by means of compressed air, a compression of from 80 to 100 lb. per square inch being necessary. The bulb, prior to starting, was made sufficiently hot to ignite the fuel, one impulse being usually enough to start the engine. The reliability of the semi-Diesel engine was of a high order in the modern types.

In conclusion, Mr. Richardson referred to the recent extension of the field of application of this engine; he foreshadowed great developments in the near future. It might be expected that the lines of development of the semi-Diesel and the Diesel engines would become more closely merged. Practical difficulties appeared to confine the semi-Diesel engine to the 2-stroke principle, and improvements in the scavenging efficiency might be expected.

Applications by non-members for invitations to attend the next meeting, at which Mr. James Richardson's paper is to be discussed, should be addressed to the Hon. Sec., Mr. Percy Still, M.I.E.E., 19, Cadogan Gardens, S.W. 3.

BUSINESS NOTES.

Patents and Alien Enemies.—An application by Messrs. Bluemel Bros., Ltd., for a licence in respect of Patent No. 26,436/07 granted to Bosch, has been granted by the Board of Trade.

I.E.E. Model General Conditions for Contracts.—Alteration to Clause 24.—We have received the following Order issued by the I.E.E. under date November 1st, 1918:—"In the case of contracts made on and after January 1st, 1919, the amounts of the instalments of the retention money specified in Clause 24 (2) will be altered from 10 per cent. and 10 per cent. to 15 per cent. and 5 per cent. respectively.

Trade Announcement.—The Record Engineering Co., Ltd., has removed its offices from Southampton Street to Donington House, Norfolk Street, Strand, W.C. 2, where all communications should be addressed.

Liquidations.—Beck Engineering Co., Ltd.—A petition for the winding-up of this company, presented by Mr. S. W. Doune, of Wimbledon, creditor, will be heard on November 12th.

Vulcanized Fibre, Ltd.—This company is winding up voluntarily, with Mr. C. Cooper, of Spring Gardens, Manchester, as liquidator; meeting of creditors, November 15th.

British High-Power Gas Engine Co., Ltd.—Meeting, December 10th, at Moorgate Hall, Finsbury Pavement, E.C., to hear an account of the winding-up from the liquidator, Mr. F. G. Palin.

American Copper.—According to a Reuter's cable, the United States Government have decided upon a retention of the fixed price of copper at 26 cents per lb. until January 1st next. This decision is in accordance with expectations, despite demands for an advance based on higher working costs. The change in the war situation may have influenced the decision, and it is to be noted that the retention of the price is for a couple of months only. Meanwhile labour difficulties, which had impeded mining as well as smelting operations, have abated somewhat. The returns of the Phelps Dodge Corporation have been declining steadily, but some of the large producing companies like the Utah, the Chili Copper, and the Cirro de Pasco, the Porphyry producers, and the Lake companies have been showing better results. The aggregate output of the 20 leading producers shows for August an increase of roughly 5,000 tons, and for the eight months there is a notable increase on last year's figures. The position of the metal seems certainly to be easing by degrees.—*Scotsman.*

Australian Copper Situation.—August papers just to hand show that the Abercrombie Copper Mining Co. had closed down its furnaces, confining work to the breaking of ore in anticipation of a renewal of treatment in the indefinite future. The curtailment was being practised throughout the whole State. The cause was that the British Government was unable to renew the copper contract, which expired on June 30th. The contract covered the whole of the metal produced. Being unable to get the copper away, the works were partly closing down in August, when there was about two million pounds' worth of copper, the property of the British Government, in Sydney, awaiting shipment.

Australian Telephone Manufacturing Industry.—It was stated in Sydney, in August, that the Government report on the possibility of establishing the manufacture of telephone instruments and equipment in the Commonwealth had been completed.

Electric Lamp Manufacture at Chile.—It is reported that a company has been formed at Santiago for the manufacture of incandescent electric lamps, and the initial results obtained are considered satisfactory.—*Review of the River Plate.*

Bankruptcy Proceedings.—E. C. Sparkes, described as an electrical manufacturers' agent, of 118, Wardour Street, Oxford Street, W.—The first meeting of creditors was held on October 30th, at the London Bankruptcy Court. The receiving order was made on October 17th, upon the petition of Messrs. Burt, Escaré and Denelle, and accounts have been lodged showing liabilities £352 against assets "nil." Mr. J. B. Knight, Official Receiver, reported that it appeared from the debtor's statements that prior to 1915 he acted as agent for various firms, the chief being J. W. Stokes, of Arnham, Holland; S. M. Woolf & Co., of Wervechyhavers, Germany; S. Heath & Son, Birmingham; and Peyton & Peyton, Birmingham. The war completely stopped the business, and since then the debtor had dealt as principal in electrical goods, but only in a small way. In the absence of any offer the case was left in the hands of the Official Receiver to be wound up in bankruptcy. The following are the principal creditors:—

Unsecured.		Unsecured.	
A. and A. Electrical Co., Ltd.	£15	Morgan Crucible Co.	£13
Burt, Escaré & Denelle	86	Radio Electric Co.	25
Bisscher & Co.	10	Southall Lamp Co.	30
British Thomson-Houston Co.	16	Tyler Apparatus	24
Hewson Manufacturing Co., Ltd.	12	Veritys, Ltd.	10
Imperial Lamp Co.	45		

The British Metals Corporation.—In the House of Commons on Monday, in reply to questions, Mr. G. J. Wardle said that no financial assistance had been promised or would be given to this company by the Government. There was no intention to accord to the company any preferential treatment as compared with other British controlled companies having similar objects.

Book Notices.—*Brassfounding.* By Joseph G. Horner. London: Emmott & Co., Ltd. 1918. Pp. viii + 182; figs. 247. Price 5s. net.—The literature which deals with the subject of brass moulding and founding is scanty, and not of recent date. This practical treatise is offered as an attempt to deal with the leading principles and practice of an interesting trade. The substance of this book has already appeared in the *Mechanical World*, but considerable space is given to descriptions of furnaces, and new matter relating to the latter has been added. In the first chapter the origin of brass is discussed; Chapter II deals with furnaces, many types of which, as well as recent improvements and economies in working, are described. Sands and crucibles are also briefly dealt with in this chapter. Chapter III is devoted to appliances, including moulding troughs, boxes, retention sand, &c. Joints, joint boards, odd sides and plates are dealt with in Chapters IV and V, while in the sixth chapter patterns, methods of constructing them, &c., are discussed. In the seventh and last chapter examples of moulds are given. Although not a comprehensive treatise on the subject, it is one which is reasonably complete. It should be of service to apprentices and students, as well as to the pattern-maker and moulder, for whom the last two chapters were written.

"B.E.A.M.A. *Journal*." No. 4, Vol. IV. October, 1918. London: King's House, Kingsway, W.C. Price 1s. net.

"Science Abstracts." Vol. XXI, Part 9. September 30th, 1918. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"*Journal* of the Franklin Institute." Vol. 186, No. 4. October, 1918. The Institute: Philadelphia.

Messrs. Automatic and Electric Furnaces, Ltd., have sent us their "Heat Treatment Bulletin," No. 4, for October, showing the effect of tempering on water-quenched gauges, and giving precise instructions for the use of the Wild-Barfield furnace and quencher.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVII, No. 10. October, 1918. New York: The Institute. Price $1.

Patent Restoration.—Application for restoration of Patent No. 3,814, of 1912, for "Improvements in sound reproducers," has been made by Thos. A. Edison.

Electrochemical Works.—The Electric Chemical Development Co. has decided to open works at Wolverhampton.

Deed of Assignment.—S. H. Barton (Engineering Supplies Co.), 11, King Street, W. Manchester.—Claims by November 16th, to Mr. J. R. Atkins, trustee, 14, St. Ann's Square, Manchester.

Germans in Argentina.—The *Times* Buenos Ayres correspondent states that the Germans are trying to persuade neutral buyers to cancel their orders by promising to supply all requirement at pre-war prices immediately after peace is declared. The prospect of a rapidly falling market creates a tendency to listen to these counsels, and some firms almost display eagerness to secure their inclusion on the "Black List," so as to evade their present commitments.

Electrical Developments in Sicily.—The British Consul at Palermo states that at an extraordinary general meeting of the shareholders of the Società Elettrica della Sicilia Orientale, held at Milan, on August 22nd, it was decided to increase the capital of 15,000,000 lire to 32,000,000 lire (or to 40,000,000 lire by June 30th, 1919, at the discretion of the board), and to change the name of the company to Società Generale della Sicilia, with a view to extending its power stations and activities over the whole island, and especially in the Province of Palermo and in the central region of the sulphur industry.—*Board of Trade Journal.*

Our Commercial Counsellors.—Sir A. Steel Maitland, referring to the reorganisation of the Consular Service which was in hand, said that the commercial counsellors who would be attached to the Service had been selected, and were just going out.

British Manufacturers and Dominion Factories.—Under the heading "A Grievance of British Manufacturers," the writer of the *Times* City column says:—"The recent movement among British manufacturers to form connections in the Dominions for the purpose of erecting jointly-owned plants to protect their trade is not making as much progress as it would do if they were not subjected to various hindrances. When the manufacturers have applied to the Treasury for permission to invest the necessary funds, the officials, we are told, have made it plain to them, even when limited assent has been given, that requests of the kind receive a very cold reception. Another difficulty is that the Priority Department at the Ministry of Munitions has not shown much appreciation of the importance of the movement, for the Dominions have not obtained any preferential, if indeed equal, treatment over foreign buyers of plant and machinery. It is urged that neither the Treasury nor the Priority Department realise that they are handicapping British manufacturers in their competition with foreign firms by the lack of sympathy and help which they reveal in dealing with applications from British manufacturers. It is pointed out, for instance, that in Japan important manufacturing interests have arisen which will compete with European goods. In metal manufactures, particularly of copper, zinc, and brass, Japan is doing a most active trade in the Orient, and introducing her wares into Australia. In the chemical and textile trades she has shown exceptional enterprise. The war, of course, rendered the development of Japanese trade inevitable, but the complaint of the British manufacturers is that Government Departments should not render foreign competition more formidable for them by adopting an unsympathetic attitude towards after-war plans."

LIGHTING AND POWER NOTES.

Aberdeen.—Wages.—The T.C. has increased the wages of employés at the electricity works by 3s. 6d. per week to men and women over 18 years of age, and by 1s. 9d. per week to those under 18, from the first pay-day in October last; overtime and Sunday rates are to remain as at present, and no further revision of wages is to take place for four months from October 1st last.

Argentina.—E.L. Schemes.—A co-operative society is to be formed by the residents of Tres Arroyos (Province of Buenos Ayres) for the installation of electric light and power; the municipal authorities of Saavedra have invited tenders for the erection of an electricity generating station in the town of Pigué. The electric power station at Barrancas (Province of Santa Fé) suspended supply in September, owing to lack of fuel.—*Review of the River Plate.*

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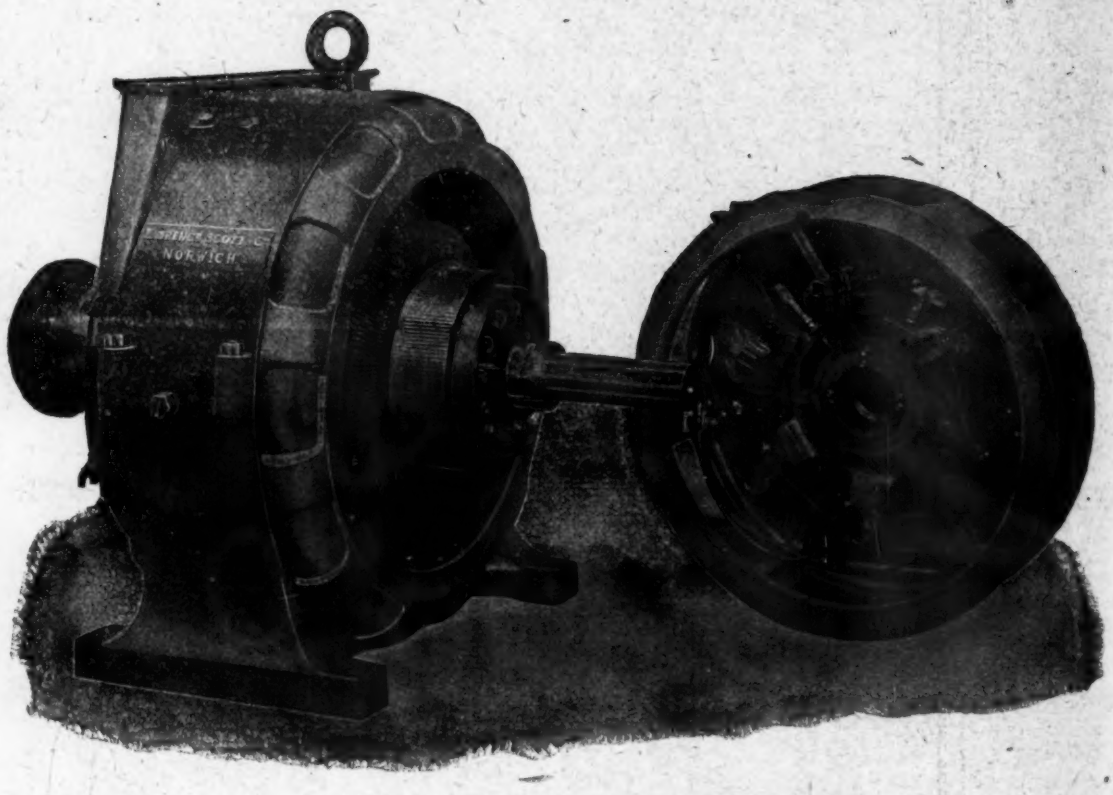

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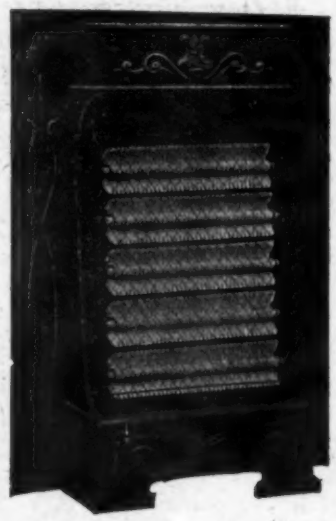

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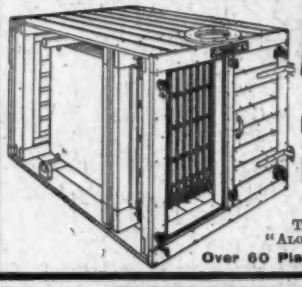

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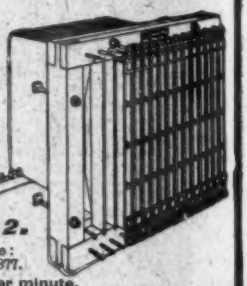

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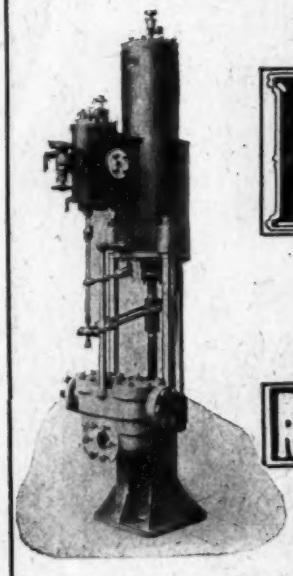

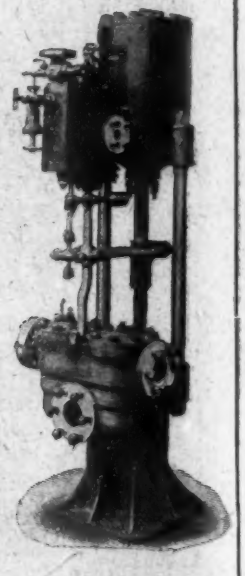

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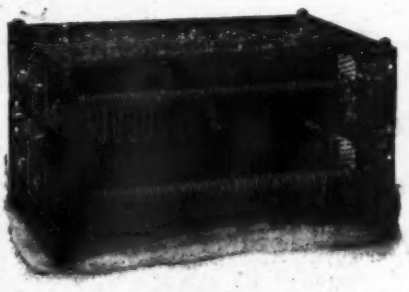

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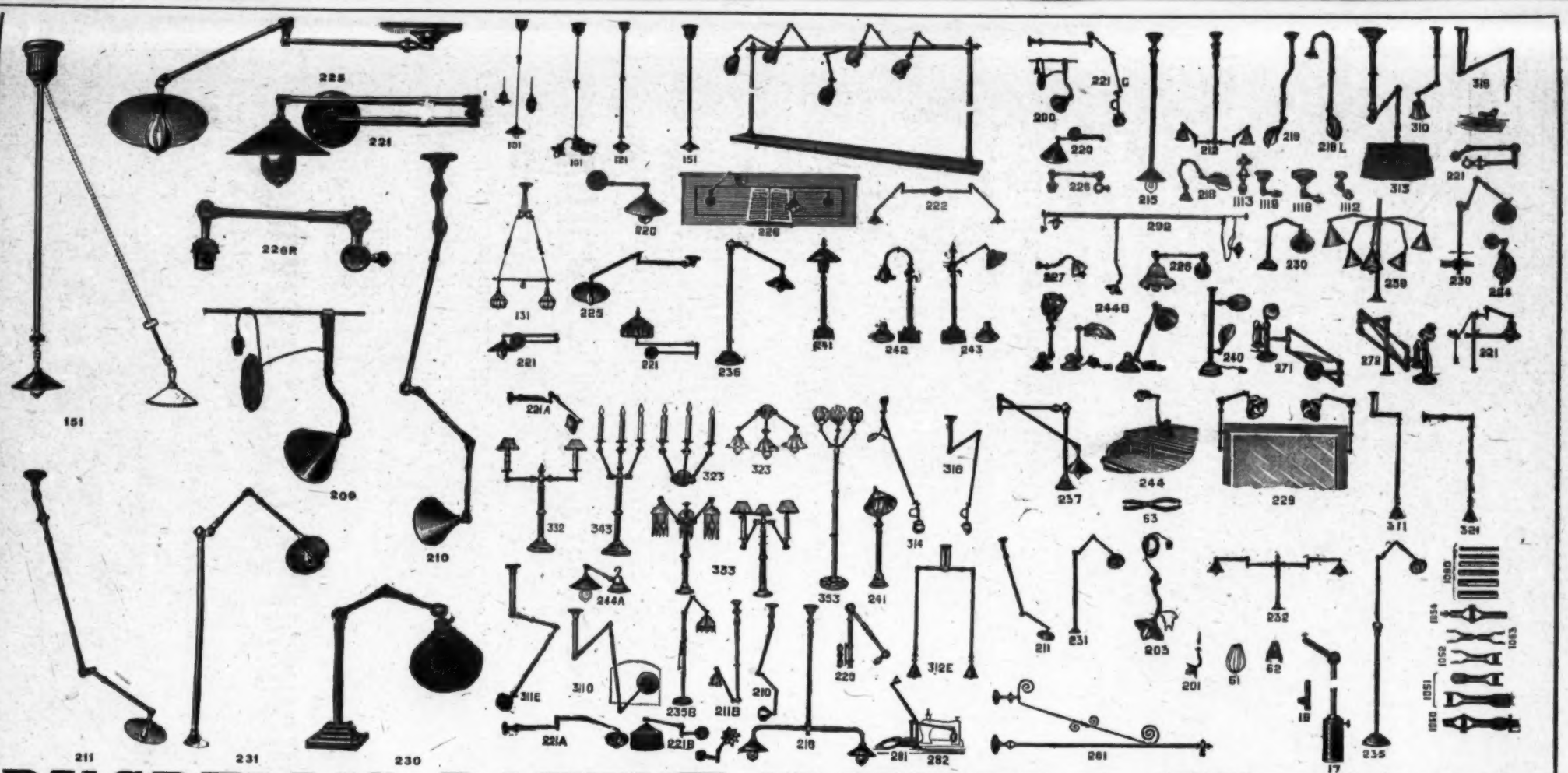

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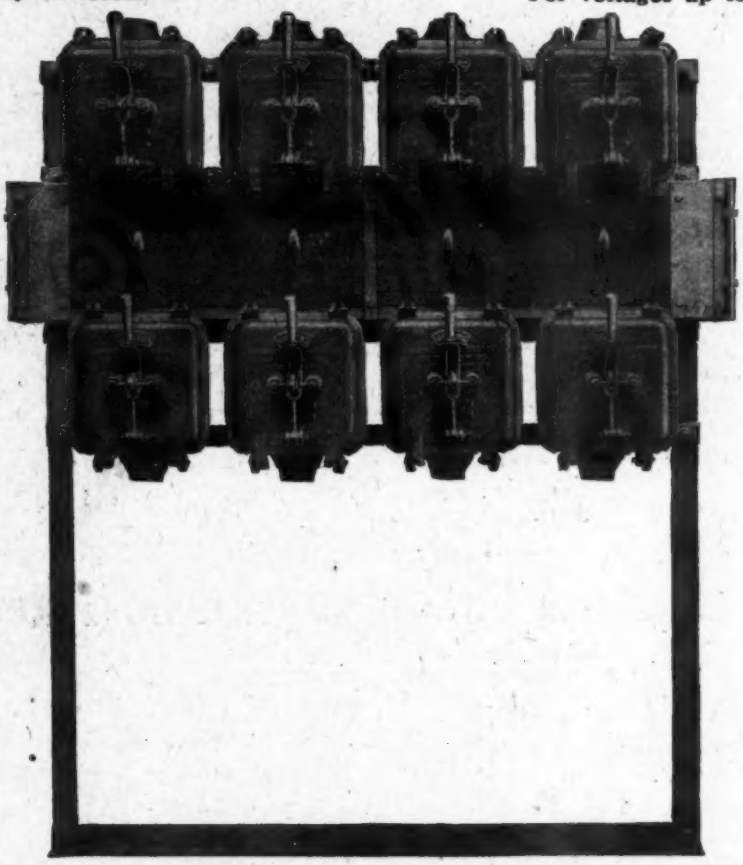

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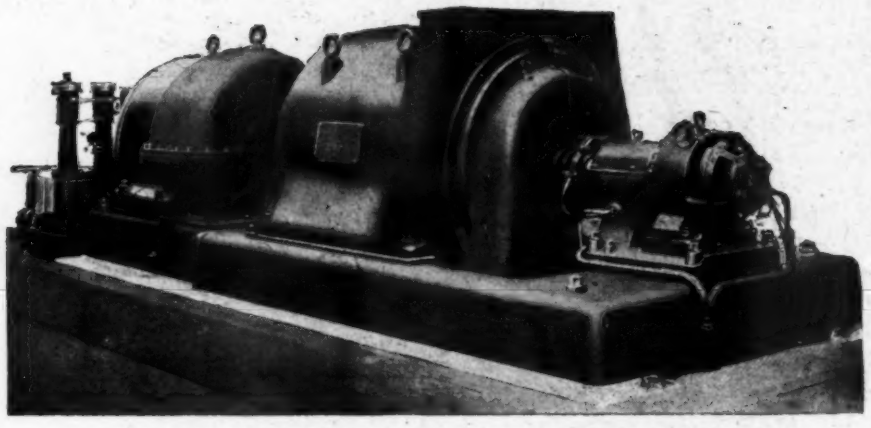

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(*Continued on next page.*)

SITUATIONS VACANT.—*Continued.*

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SWITCHBOARD ATTENDANT.

SWITCHBOARD ATTENDANT, accustomed to operating 3-phase, A.C. and D.C. switchboards.

State experience, age and wages required, with references, BOROUGH ELECTRICAL ENGINEER, Burnley. 3165

SITUATIONS VACANT.—*Continued.*

DRAUGHTSMEN.

DRAUGHTSMEN required for Government office at Portsmouth. Knowledge of electricity an advantage but not essential.

State age and experience to Box 792, Willings, 125, Strand, London, W.C. 2. 3111

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

A LARGE manufacturing company require immediately three Engineers, to be responsible during an eight-hour watch for the efficient operation and maintenance of their boiler houses. Only men with first-class experience with Babcock & Wilcox boilers and chain grate stokers need apply. Commencing salary £250 per annum.—3127, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ARMATURE Winder. Wanted a good reliable all-round Armature Winder, with some experience of A.C. work. Permanency for good man. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply to LANG AND SQUIRE, LTD., Wales Farm Road, Acton, W. 3. 3009

ARMATURE Winders required at once, for Government work. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply, stating experience, rate of wages required, to 3096, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ARMATURE Winders, used to repair shop, D.C. work. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply H. D. & S., 32, Newington Causeway, S.E. 1686

ASSISTANT Estimator for transformer work; must have some technical knowledge. No person already engaged on Government work need apply.—Apply, stating age, experience and salary required, to your nearest EMPLOYMENT EXCHANGE, stating No. A6310. 3097

ASSISTANT required for Testing and Experimental Work; must have had works training and good experience in direct-current motor testing. No person already on Government work will be engaged.—Apply by letter, stating age, experience and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning this paper and No. 5944.

BORING Mill (Vertical) Turner wanted to work two mills at present engaged on war work, but will be employed on similar work after the war, in electrical trade in London district, N.W. District rate of wages, plus bonuses. No person resident more than 10 miles away, or already on Government work, will be engaged.—3112, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CAPABLE Overhead Linesman required for the Dover Corporation Tramways; must have had experience of the erection of new trolley wires. Preference given to one with knowledge of armature repairs.—State age, experience and wages required, to GENERAL MANAGER, Corporation Tramways, Town Hall, Dover. 3064

CHARGE Engineer required for London Power House (Certified Undertaking), must have had previous experience with turbo-alternators, B. & W. Boilers, and used to the control of men.—State the full particulars, qualifications, age and salary required, to 5968, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

COST Clerk required by a large Electrical Engineering Insurance Company. Must be used to all kinds of electrical repairs.—State age, experience and salary required, 3100, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DESIGNER (telephone instruments and kindred apparatus) required by Controlled Establishment in London area. Must be experienced man with good practical knowledge, and capable of evolving and developing new designs, particularly interphones. No person already engaged on Government work need apply.—Apply, stating age, experience and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A6253. 5894

DISTRICT Engineer required, experienced in O.H. line work, and with good knowledge of plant on consumers' premises, &c.—Apply, stating all particulars and wage required, to SCOTTISH CENTRAL ELECTRIC POWER CO., 1, Kirk Wynd, Falkirk. 2877

DRAUGHTSMEN (Apparatus), required immediately by Controlled Establishment in London area, with good experience of telephone instruments and kindred apparatus, and magnetos for spark ignition. No person already engaged on Government work need apply.—Apply, stating age, experience and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A6254. 5896

DRIVER Attendant wanted for A.C. turbine plant, for a factory in the North of England.—Apply giving experience, 3041, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(*Continued on next page.*)

SITUATIONS VACANT.—*Continued.*

ELECTRICAL Engineer for Glasgow district, to take charge of Testing Department; first-class man wanted with experience in contactor control gear. No person on Government work will be engaged.—Apply, giving salary and earliest date can start, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A6324. 3107

ELECTRICIAN wanted by a large industrial concern near London. Must have good all-round experience in maintenance work and extensions, accustomed to repairs to motors, switchgear, and modern electric light installations; good prospects for the right man.—Reply, giving full particulars of experience, references and wages required, to 3160, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN wanted for maintenance in large factory in the East End of London. Must be accustomed to taking charge of power and lighting and general plant work, and willing to reside in the district. Apply by letter, stating full particulars of experience.—3144, ELECTRICAL REVIEW 4, Ludgate Hill, London.

ELECTRICIAN wanted, to look after C.A.V. lighting on fleet of motor-buses.—Apply MANAGER, Tramways Co., Oxford. 2978

ELECTRICIANS required for Motors, lighting and telephones (usual clauses), only competent men need apply. No person resident more than 10 miles away, or already on Government work, will be engaged.—W. T. CLARKE & Co., LTD., 10, Silver Street, W.C. 1. 3156

ENGINE Room Charge Engineer required, experienced in turbines and large reciprocating E.H.T. 3-phase sets. State experience and salary required.—3116, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER of Methods, for Planning Department, required immediately by Controlled Establishment in London area, 2,000 employés, for small and accurate repitition parts of electrical instruments. Electrical knowledge essential. Applicants must be first-class mechanics, and be able to organise a growing department. Preference given to one with knowledge of piece rates. Only applicants having held a similar position need apply. No person already engaged on Government work need apply.—Apply, stating fully, experience, age and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A6255. 5895

EXPERIENCED Foreman or Forewoman required to take charge of flashing and mounting department, carbon filaments. No person resident more than 10 miles away, or already on Government work, will be engaged.—9728, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FITTER required in Central Station. Previous knowledge desirable of turbines and other central station plant. Wages 10½d. per hour, plus bonuses.—Apply 50, Eden Grove, Holloway, N. 7. 5979

FOREMAN Electrician wanted by a firm of Marine Engineers and Shipbuilders; first-class practical man, fully conversant with Admiralty work and the wiring of vessels, also to supervise factory plant. No person on Government work will be engaged.—Apply, stating age, experience and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A6354. 3140

FOREMAN Electrician wanted, used to supervision of men engaged on all classes of electrical work. No person already on Government work will be engaged.—Apply nearest EMPLOYMENT EXCHANGE, stating experience, salary, &c., and mentioning No. A6280. 5877

FOREMAN wanted, by large electrical concern, to take charge of manufacture of electrical meters and instruments for industrial purposes. Applicant must be able to supervise both male and female labour on machining and assembling operations, fix piecework prices, and have had experience in a responsible position on similar work. Permanent and progressive position. No one already on Government work will be engaged.—Apply with particulars of experience, age and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning A6123. 3113

IMPROVER wanted in a 3-wire D.C. generating station.—Apply, in first instance, to 3162, ELECTRICAL REVIEW, 4, Ludgate Hill, London, stating age, training and wages expected.

INSTRUMENT Makers, Tool Makers, and Setters wanted for urgent Government work; also Floor Inspector. Must be first-class men. No person resident more than 10 miles away, or already on Government work, will be engaged.—Address FULLER ACCUMULATOR CO., LTD., Grove Road, Chadwell Heath. 3104

INSTRUMENT Repairer required for repairs to meters and electrical instruments. Good small lathe hand essential, used to accurate work. Wages 10½d. per hour, plus bonuses.—Apply in writing, giving particulars, 50, Eden Grove, Holloway, N. 7. 5980

LONDON manufacturing firm require Switchgear Draughtsmen. No person on Government work, or living more than 10 miles away, engaged.—Apply, stating age, experience, and salary required, to 5943, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MECHANIC with knowledge of electricity and electric lamp manufacture required; discharged officer or man preferred. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply, stating age, experience and salary required, to Box 792, c/o Reynell's, 44, Chancery Lane, W.C. 2. 5951

SITUATIONS VACANT.—*Continued.*

METER Repairer and Tester wanted. State experience, age and wages required. References required.—ELECTRICAL ENGINEER, Corporation Electricity Works, Grimsby. 3059

RATE Fixer required immediately by Controlled Establishment in London area, with experience of coil winding and small assembly work. Only those with first-class mechanical knowledge need apply. No person already engaged on Government work need apply.—Apply, stating age, experience and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A6256. 5893

REQUIRED, capable man as assistant for the Electrical and Engineering Section of the Buying Department of an important company. Commencing salary £250.—Reply, giving full particulars of experience and copy testimonials from past employers, to Z. S., 878, c/o Deacons, Leadenhall Street, E.C. 3. 5966

REQUIRED, Draughtsman in Central Station, mechanical training desirable. Wages £2 15s. plus bonus.—Apply in writing giving particulars, 50, Eden Grove, Holloway, N. 7. 5978

REQUIRED, Engineer's Fitter, experienced in the maintenance of Babcock, Wilcox and Dry-back Boilers, Reciprocating and Turbine Engines and Auxiliary Plant of Electric Power Station. No person already engaged on Government work need apply.—Call your nearest EMPLOYMENT EXCHANGE, quoting No. A 6290. 3071

REQUIRED immediately, a Capable Man for testing, recalibration and repairs of A.C. and D.C. Meters and Instruments generally.—Apply, with full particulars of experience together with salary required, to GENERAL MANAGER, Power Station, Downing Street, Smethwick. 3092

REQUIRED, three adult males and one junior, suitable for preparation of manufacturing layouts. Must be capable of calculating weights and quantities of material necessary for manufacturing articles used by telephone and electrical engineers, and able to read drawings, micrometers, define and describe sequence of operations. Progressive permanent berth. No man already engaged on Government work need apply.—Apply your nearest EMPLOYMENT EXCHANGE, mentioning No. A6126. 3151

SEVERAL experienced Magneto Testers wanted. Good position for reliable men. No person on Government work will be engaged.—Apply your nearest EMPLOYMENT EXCHANGE, mentioning A6316. 3101

SIX Men required, used to good class switch work; also six Armature Winders. No person resident more than 10 miles away, or already on Government work, will be engaged.—J. STONE AND CO., LTD., Deptford, London, S.E. 2944

SHIFT Engineer required for certified undertaking engaged on munitions work. Experience on Babcock & Wilcox boilers, turbo-generators and E.H.T. 3-phase supply essential. Salary 65s. (including war bonus) plus 12½ per cent.—Apply, with full particulars of experience, age, &c., to KENT ELECTRIC POWER CO., Railway Street, Chatham. 5965

SHIFT Engineer wanted for controlled establishment; must have good electrical and mechanical experience. Good wages according to qualifications.—Apply, stating age, experience, when at liberty, &c., with copies of recent testimonials, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A6331. 3109

STOREKEEPER required who has had good experience in a modern stores dealing with all kinds of electrical apparatus. No person already engaged on Government work, or residing more than 10 miles away, need apply.—Apply, stating age, full particulars of experience, with dates and salary expected, to J. STONE & Co., LTD., Works Dept., Deptford, S.E. 14. 2966

SUB-STATION Attendant required, with experience of rotaries and H.T., 3-phase system; ineligible; permanent; 6s. 6d. per 8-hour shift, plus war bonus 23s. 6d. and 12½ per cent. weekly.—3053, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

THOROUGHLY capable Works Foreman required for large generating station (London), qualified to supervise repairs to water-tube boilers, large reciprocating engines and coal and ash plant. State experience and salary required.—3115, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

THREE good Armature Winders and one Fitter, required, good positions for right men. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply E. M. C., 18, Gun Street, E. 1. 5829

TRAVELLER wanted, for Electrical Fittings and Accessories, for London district; previous experience; permanency. No person resident more than 10 miles away, or already on Government work, will be engaged.—3108, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, a Cost Clerk, preferably with experience in cable and electrical manufactures. Must be capable of instituting and organising detailed costing department. Applications must contain full particulars of experience and salary required. No person resident more than 10 miles away, or already on Government work, will be engaged.—2995, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(Continued on next page.)

SITUATIONS VACANT.—*Continued.*

WANTED, a first-class Electrical Fitter (lighting, bells, &c.), for a really reliable man with good record. There is a permanency waiting at 1s. 6½d. per hour. No person resident more than 10 miles away, or already on Government work, will be engaged.—ELECTRIC LIGHT INSURANCE & MAINTENANCE Co., 1/2, Rupert Court, Piccadilly, W. 1. 3012

WANTED, an Electrical Engineer, for a large Manufacturing Works in the Midlands; a first-class man able to undertake repairs to motors, up-keep, and lighting, and also undertake any additional wiring or setting down of motors; first-class man will have every encouragement, permanent situation; full particulars of experience and present and past employers; hours 6 to 5.30. Wages £5 5s. per week including bonus.—3143, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, by a firm in the S.E. district engaged on munition work, first-class Telegraph Mechanics. No person resident more than 10 miles away, or already employed on Government work, will be engaged.—State age and experience to 6125, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, by firm of magneto manufacturers in London, a Buyer and Assistant Buyer. No person resident more than 10 miles away, or already on Government work, will be engaged.—Write, stating full experience, age and salary required, to B.A., c/o Dixon's, 195, Oxford Street, W. 1. 5936

WANTED, by leading engineering insurance company, Electrical Surveyors, having good knowledge of the theory and practice of alternating and direct current plant. Applicants must be ineligible for the Army or Navy.—2581, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Car Shed Fitter for night duty for adjusting brakes and carrying out small running repairs.—Apply, stating experience, wages required, enclosing copies of testimonials, to G. H. BROWN, Esq., Engineer & Manager, Mexbro' & Swinton Tramways Co., Dale Road, Rawmarsh. 3146

WANTED, Electrical Fitter for factory maintenance work and sundry new installations. Continuous employment for suitable man; East London. No person resident more than 10 miles away, or already on Government work, will be engaged.—Write, stating experience and wages, &c., 3094, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED Electrician for small three-phase plant, South Coast. No person at present engaged on Government work need apply.—Apply, with full particulars, to your nearest EMPLOYMENT EXCHANGE, quoting No. 5833.

WANTED, Electrician to assist Engineer with the maintenance and repairs of a large Factory Plant, situate about 60 miles west of London. Good wages and part removal expenses will be paid to suitable man.—State age and full particulars to 5940, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, experienced Diesel Engine Drivers.—Men willing to train should also apply to LEATHERHEAD ELECTRICITY WORKS, Leatherhead. 5981

WANTED, for Bell and Telephone Maintenance, good man. No person already employed on Government work will be engaged.—Apply your nearest EMPLOYMENT EXCHANGE, mentioning No. A6262. 3135

WANTED, for the Midlands, Electrical Instrument Maker for repair work; good wages paid to suitable applicant. Nobody employed on Government work will be engaged.—Apply to your nearest EMPLOYMENT EXCHANGE, mentioning this paper and No. A6248. 3017

WANTED for the permanent staff of a provincial electricity supply undertaking, Constructional Engineer and Draughtsman.—Applications, stating full particulars of past experience, together with copies of testimonials, and the total remuneration now required, 3170, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, for urgent Government contracts, Instrument Makers; must have had experience with both moving coil and moving iron types of ammeters and voltmeters, for factory in N.W. district. No one already engaged on Government work, or residing more than 10 miles away, need apply.—Send full particulars to 3049, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, General Assistant to Works Manager in an old-established electric lamp factory. Good opening and progressive salary. No person already on Government work will be engaged.—Apply your nearest EMPLOYMENT EXCHANGE, mentioning No. A5667. 2037

WANTED, General Hand for truck repairs; knowledge of wheel-press, overhauling and changing armatures essential. Wages 53s. 6d. per week of 56 hours.—Apply GENERAL MANAGER, Dover Corporation Tramways, Town Hall, Dover. 3065

WANTED, Purchasing Agent; should have experience in purchasing electrical stores and fittings, works stores, &c. Applications must contain full particulars of experience and salary required. No person resident more than 10 miles away, or already on Government work, will be engaged.—2994, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS VACANT.—*Continued.*

WANTED, Wireman, wiring and general repairs (controlled firm); rate 1s. 6d. per hour, including all bonuses.—3043, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Works Manager, with special knowledge of Accumulator manufacture, preferably with experience of traction batteries. Must be practical, energetic and good organiser. Applications must contain full particulars of experience and salary required. Only first-class men need apply. No person resident more than 10 miles away, or already on Government work, will be engaged.—2996, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WIREMAN, experienced in ships and works lighting and power installations. No person already on Government work will be engaged.—Apply, stating experience, &c., to nearest EMPLOYMENT EXCHANGE, mentioning No. A6280. 5878

WIREMAN, for London, capable undertake installations; must be thoroughly reliable; good wages and prospects. No person resident more than 10 miles away, or already on Government work, will be engaged.—5935, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS WANTED.

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AQUALIFIED Electrical and Mechanical Engineer desires a position as Inspecting Engineer or position of similar importance. Many years in this particular line.—5902, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ACCOUNTANTS, undertake income tax, balance sheets, book-keeping; moderate.—53, Crayford Road, London, N. 7. 5934

ADVERTISER, A.M.I.E.E., with over 18 years' exceptional experience and technical training as cable engineer, desires re-engagement.—5817, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER as Foreman, full control factory or large contracts, power and lighting, 26 years' experience; permanency required; shortly disengaged.—5821, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER wishes engagement as Electrician or Supervisor, power, lighting, or factory.—G., 137, Sulgrave Road, Hammersmith, W. 6. 5910

ALL-round Engine Fitter (practical) seeks situation in small firm on engines (internal, gas, steam, oil), or shop on small parts.—5868, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AN Electrical Engineer, holding responsible position, with full technical and workshop qualifications, can shortly be at liberty. Large experience in high-tension and low-tension power and sub-station installations, running of plant, designs of switchgear, and cabling.—5904, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AN Electrical Engineer, well versed in all Admiralty practices on H.M. ships, and at present employed in one of H.M. principal dockyards, desires an equivalent position where ability and zeal are not hampered by red tape.—5952, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AN Engineer, electrical and mechanical, accustomed to carrying out large contracts. Good organiser, and thoroughly experienced in the management of large numbers of men.—5831, ELECTRICAL REVIEW, 4, Ludgate Hill, London

AN Engineer, young, ineligible, technical training. Not shift work. London preferred.—5984, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

BELGIAN Engineer, University degree, practical experience and commercial ability, knowledge of English, Italian and Greek, wish communicate with first-class firm with a view of post-war situation on the Continent.—5942, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CHARGE Engineer desires permanent post; 16 years' sound experience, A.C. and D.C., &c.—Mr. B., c/o Baldwin, 47, Cliffe Street, Keighley, Yorkshire. 5928

COMPETENT Electrician desires charge of installation. Southern Counties.—5948, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL and Mechanical Engineer desires post as Inspector or Charge of Test Room; well up in small motor, switchgear and projector work; 15 years' experience.—5960, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL and Mechanical Engineer, with 14 years' first-class theoretical and practical experience of large plants, E.H.T., single, polyphase and D.C., seeks responsible position: specifications, drawings, erection and complete maintenance.—5827, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(Continued on next page.)

SITUATIONS WANTED.—*Continued.*

ELECTRICAL Engineer, thorough technical and workshop qualification. Twelve years' practical experience in manufacture, test-bed, outside engineer, inspection and technical representative. Possesses initiative and organising capabilities, desires responsible position.—5947, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer, with mechanical training, shortly disengaged, desires an appointment where ability and initiative are appreciated; charge of works plant or similar capacity. Commencing salary £5 per week; discharged service.—5918, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer, with wide and varied experience in lay out, erection and maintenance of large power and lighting plants, accustomed to control a large number of men, desires a responsible position on Government work.—5975, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer (32) desires change. At present in charge of large generating plant, motors upkeep, repairs in large factory. Conversant with supervising and layout duties, both technical and practical. Strict habits. Good references.—State salary offered, hours, &c. (in confidence), to B. M. L., 5941, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Wireman's Assistant seeks situation (16).—W. P., 143, Ilderton Road, North Camberwell. 5969

ELECTRICIAN, good wireman, all branches; late charge.—W., 113, Albert Street, N.W. 1. 5988

ENGINE Fitter, seeks berth as foreman or charge hand of shop. All-round man.—5828, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINE Fitter (47) seeks berth as Foreman or Charge Hand, general, aero. gas, steam, or shop on small parts.—5867, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER, A.M.I.C.E., A.M.I.E.E., with 13 years' practical experience, including instrument and experiment work, is free for suitable engagement.—5977, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FIRST-Class Winder, alternating and direct-current; 8 years' experience in manufacture and repairs, all types; good all-round mechanic; young and energetic; seeks charge or other responsible position.—"ENGINEER," 27, Chetwode Road, Balham S.W. 17. 5844

INTELLIGENT Youth seeks situation as Electrical Assistant; age 17. Some general experience.—MILLER, 69, Netherwood Road, W. 14. 5982

JOINTER, used to general mains work, motors, meters, locating faults, &c.—Apply W. C., 12, Mortimer Terrace, Highgate Road, London, N.W. 5. 5883

LADY Shorthand-Typist desires change to South country (not London); 8½ years' experience; present position over four years.—5967, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MANAGER or Works Manager, shortly disengaged, 26 years' works experience, electrical instruments; practical, energetic, and good organiser, will take financial interest; can introduce new post war lines.—5945, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MECHANICAL and Electrical Engineer, A.M.I.E.E., desires change. Grade 3. Age 40 years. 22 years' experience, manufacture, design, and administration. Specialising in telephones, telegraphs, cables, aeroplanes, and aeroplane engines. Excellent references.—5854, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

POST required, Shift Engineer used to Diesels and switchboard, A.C. plant; not eligible.—E. J. B., Gordon House, Gordon Road, Ashford, Middlesex. 5962

SHOP Engineer, Assistant Works Manager, or other suitable position, required now or post War by University-trained Electrical Engineer, aged 29. Four years technical design Alternators and Induction Motors; 14 months Assistant Electrical Engineer, H.M. Factory. Test house, power house records and accounts, workshop supervision, technical editorial experience. Knowledge French and Publicity.—5955, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TO Electrical Cable and Wire-drawing Manufacturers.—A life-long practical expert in wire-drawing, who has laid down and worked plants at W. T. Henley's Telegraph Works, London, W. T. Glover, Trafford Park, Manchester, and others, wishes to meet firm either at present engaged in, or contemplating entering upon, wire-drawing, with a view to appointment as Superintendent Wire drawer. His services are immediately available.—Write to 5897, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WIREMAN-Electrician wanted, long experience, full rate.—"ELECTRICIAN," 33D, Deacon Street, Walworth, S.E. 5987

SITUATIONS WANTED.—*Continued.*

WORKS' Manager seeks berth; 13 years' practical and theoretical experience in supervising of winding shop; knowledge of small motors, fans, &c., unique; just disengaged. London district or South Coast preferred.—5903, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

YOUNG man (29), recently discharged H.M. Forces, with exceptional experience wholesale electrical supplies trade, seeks responsible position with firm of repute. Prior to enlisting secretary to well-known London wholesale house. Would open London branch, wholesale department, or act as sales manager, buyer, &c. for progressive concern. Capable organiser and thoroughly experienced control of staff.—TOOGOOD, 6, Madeira Road, Leytonstone, Essex. 5959

PARTNERSHIPS.

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ELECTRICAL Engineer (33), A.M.I.C.E., A.M.I.E.E., with varied experience, including instrument and research work, desires responsible post. Would invest £1000 in sound concern.—5976, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

REQUIRED, a smart man to join another in an established Wholesale Accessories Business. Capital £500.—3167, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AGENCIES.

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ACCUMULATORS, suitable for motor and country house lighting. Advertiser is desirous to represent reliable manufacturers in the Midland Counties.—5963, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AGENCIES for Midlands, North of England and Ireland, wanted by experienced Electrical and Mechanical Engineer, for Electrical and Mechanical Machinery, Supplies, &c.—Full particulars to 5957, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR SALE.

URBAN DISTRICT COUNCIL OF DARTFORD.

Sale of Electrical Plant.

THE COUNCIL offer for Sale, two Reavell-General Electric Co., compound-wound Steam Generators, steam pressure 150 lbs. Output 200 amperes at 480/550 volts. Sundry spare engine parts are included.

The plant may be inspected by appointment with the electrical engineer, MR. J. D. PEMBER, of the Electricity Works, Dartford, from whom full particulars may be obtained.

Tenders for the purchase of the plant, in envelopes, endorsed "Purchase of Electrical Plant," should be sent to me at the address named below, not later than WEDNESDAY, 27th NOVEMBER.

The Council do not bind themselves to accept the highest or any tender.

GEO. M. PRESTON,
Acting Clerk to the Council.

Council Offices,
Dartford,
4th November, 1918. 3114

ELECTRICAL PLANT FOR SALE.

ONE 300-KW., 220/250-volt Generating Set, comprising "Howden" enclosed compound engine, coupled to compound interpole Generator.

One 500-KW., 220/250-volt Generating Set, comprising "Belliss" enclosed compound engine coupled to compound-wound Generator, and complete with condensing plant.

One 450-KW., 500-volt Set, as above, with or without condensing plant.

THE PHŒNIX ELECTRICAL CO.,
32—36, Broomielaw,
Glasgow. 2429

OIL ENGINE AND MOTOR.

11½-H.P. Horizontal Oil Engine, by Gardner for sale, not yet removed from makers' case; immediate delivery can be given, and no certificate is required.

2-H.P. protected shunt Motor, by Vickers, with Blower suitable for five Smith's fires, in new condition.

5889, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

(*Continued on next page.*)

FOR SALE.—*Continued.*

MACHINERY FOR SALE.

SCREW-driven Planing Machine, to plane 14′ by 4′ by 4′, by Hulse & Co.

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ONE 500-KW. triple-expansion Set, engine by Browett and Lindley, H.P. cyl. 17½″, I.P. 25″, L.P. 35″ × 14″ stroke. Single-phase Alternator, by British Westinghouse Co., 2100 volts, complete with exciter, &c.

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One Parsons Steam Turbo, 1500 KW., 2-phase, 2000 volts, 50 periods. Complete with condensing plant.

One Willans-Parsons Steam Turbo Set, 1200 KW., with Alternator, 1200 R.P.M., 200 lbs. to sq. in., 11,000 volts, three-phase, complete with exciter, also condensing plant, air, and circulating water pumps, &c.

One Surface Condenser, by J. & H. McLaren, capacity 3000 cls. per hour, with circulating pump.

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FOR SALE.—*Continued.*

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MAGNIFICENT 500-H.P. Horizontal Tandem Gas Engine, together with 350-KW. Alternator, by G.E.C., 230 volts, three-phase. Price £2,500. Set will be sold separately if desired.

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3150, ELECTRICAL REVIEW,
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(Continued on next page.)

FOR SALE.—*Continued.*

ELECTRIC MOTORS FOR SALE.

D.C. MOTORS.

	H.P.	Volts.	R.P.M	Winding.	Makers.	Type.
One	25	420	865	Com.	Holmes & Co.	Enc. vent.
,,	20	460/550	800	Shunt	B.T.H.	,,
,,	15	440	800	,,	Royce, Ltd.	,,
,,	15	230	840	,,	,,	,,
,,	8	230	480	Com.	,,	,,
,,	12	200/220	950	Shunt	Lancs. Dynamo	,,
,,	10	460	900	,,	Keighley Elec. Co.	,,
Two	13	420	1000	,,	Mather & Platt	Toty. enc.
One	10	420/440	1000	,,	Electromotors	Enc. vent.
,,	5	440	1250	,,	,,	,,
,,	5	220	1375	,,	General Elec. Co.	,,
Two	4	400	1150/1835	Inter.	,, ,,	,,
One	3	200	1275	Shunt	Delhi Elec. Co.	,,

A.C. MOTORS.

	H.P.	Volts.	R.P.M.	Phase.	Periods.	Makers.	Type.
One	27/30	350/400	720	3	50	Clayton Motors	Slip ring.
,,	12	420	960	3	50	Gen. Elec. Co.	,,
Three	3	420	1450	3	50	Wright & Wood	In. motor
One	5	100	1000	Single	50	,, ,,	,,

Catalogue of Stock Motors, Generators, Gas and Oil Engines free on receipt of request.

YARNALL & CO.,
Cornwall Street Ironworks,
Telephone: OPENSHAW 23. Openshaw,
Telegrams: "YARNALL, OPENSHAW." Manchester. 2913

MACHINERY FOR SALE.

FOUR 10-H.P., 480-volt, 1,000 revs., shunt interpole.
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Three 3-H.P., 480-volt, 1,350 revs., shunt.
Two 5-H.P., 200/240-volt, 1,350 revs., shunt.
One 5-H.P., 200/240-volt, 900 revs., shunt.
One 8-H.P., 200/240-volt, 900 revs., shunt.
One 12-H.P., 200/240-volt, 600/1,700 amp., totally enclosed.
Two 4-H.P., 200-volt, 90 ~, single-phase.
Two 6-H.P., 100-volt, D.C. Motors.
Motor-Generator, 200/240-volt to 70-volt, 80 amp.

C. J. FERGUSON & SONS,
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ONE Generating Set Comprising:—
"Howden" Enclosed Compound Engine for 150 lbs. steam pressure, direct-coupled to compound interpole generator, having an output of 300 KW. at 240 volts, 375 r.p.m.; built in 1910, and in first-class order.
Specification and print on request.

THE PHŒNIX ELECTRICAL CO.,
32—36, Broomielaw, Glasgow. 1943

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MOTORS, ready for immediate delivery: 15 H.P., 220 v., 900 R.P.M.; 10-H.P. Wright & Wood, 220 v., 900 R.P.M.; 81-H.P. Woolnough, 220 v., 1100 R.P.M.; 5-H.P., 220-v., 1000-R.P.M.; 7-H.P. Crompton, 440 v., 900 R.P.M.; 5-H.P. Zone, 440 v., 1500 R.P.M.; and several smaller. Also 14 A.C. Motors.—E. P. ALLAM & Co., 107/109, Gray's Inn Road, W.C. 1. Holborn 1280. "Epaltrical, London." 3166

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D.C. Starters to 150-H.P., Shunt Regulators, Voltmeters, Ammeters Switchboards and Panels: ½-H.P., 200-v., single-phase, 100 cycles Motor, £8 15s.; 25-v. 25-a. Dynamo, £11; 50-v., 10-a. Dynamo, £11 10s.; two 230-v. Motor Converters, outputs 30 a. and 40 a.; ditto 460-v. to 70-v., 70-a. 5-H.P. Oil or Petrol Engine, £15.—5973, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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(Continued on next page.)

FOR SALE.—*Continued.*

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FOR Sale, new Motor-Generator, suitable for welding, and comprising: 80-H.P., 440-volt, 35-cycle, 3-phase, slip-ring Motor, coupled to 60-KW., 110-volt, D.C. Generator.—THE PHŒNIX ELECTRICAL CO., 32/36, Broomielaw, Glasgow. 3123

FOR Sale, one almost new motor-driven Roturbo Pump; one 35-H.P., 460/500-volt, shunt-wound, interpole, enclosed ventilated type, D.C. Motor, mounted on bedplate, and direct coupled to one Roturbo with 25 ft. head or less, to deliver 130,000 to 140,000 gallons per hour at 870 R.P.M. One 8-H.P. 400/440 volts, 850 R.P.M., shunt-wound, totally enclosed type, electric Reversing Motor.—3169, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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FOR Sale, 110-KW., 220-volt, 500-R.P.M., multipolar, three-bearing Generator.—THE PHŒNIX ELECTRICAL CO., 32/36, Broomielaw, Glasgow. 3121

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FOR SALE.—*Continued.*

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190-H.P., six-pole D.C. Motor, by Ernest Scott & Mountain, 500 volts, arranged for rope drive.—HARRY H. GARDAM AND CO., Ltd., Staines. 2827

460-VOLT Dynamos or Motors for sale, 120, 163, and 240-amp. sizes.—3139, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

550/600-volt, 3-phase, 50-period, 75-K.V.A. Alternator for sale.—3138, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(*Continued on next page.*)

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ARTICLES WANTED.—*Continued.*

WANTED, direct coupled high-speed Engine, about 220-KW., 230/240 volts D.C., steam pressure 120 lbs. Full particulars re makers, price, age, and where to be seen.—3126, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, direct-coupled Set, about 50/75 KW., 220 or 440 volts, D.C., preferably the latter. Full details and price must accompany offer.—2828, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Dynamo, continuous current, 100/140 volts, about 5 KW. Speed must be between 500/600 R.P.M.—TREDEGARS, LTD., 5 & 7, Brook Street, London, W. 1. 5946

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WANTED, Feed Water Heater capable of dealing with 4000 to 5000 gallons per hour approximately.—Full particulars to ELECTRICAL ENGINEER'S OFFICE, Erith Urban District Council, Walnut Tree Road. 3130

WANTED, one each, types Ep, Ecp, L.Ra and KG, new A.E.G. Electricity Meters; state price delivered London.—5949, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, three 2-H.P., 50-period, 200/220-volt, single-phase Motors, complete with starting switches.—Particulars to ENGINEER, Electricity Works, Redditch. 3098

WANTED, Vertical Steam Engine, 100 volts, direct-coupled to 10-KW. D.C. dynamo, 220/230 volts.—State maker's number and full details to ELECTRICAL ENGINEER, Electricity Works, Lynchford Road, Farnborough, Hants. 2972

WANTED, 1-KW. compound Dynamo, 65 lbs., moderate speed; one 250-watt compound Dynamo, voltage immaterial; one 8-volt, 10-amp., compound Dynamo; one 220-volt, ¼-H.P. Motor; one 220-volt, ½-H.P. Motor.—5824, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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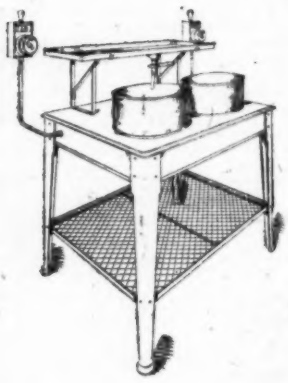

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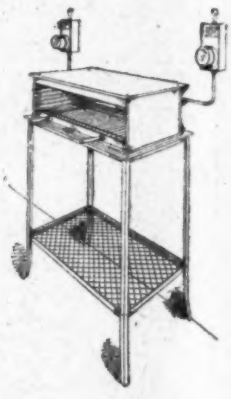

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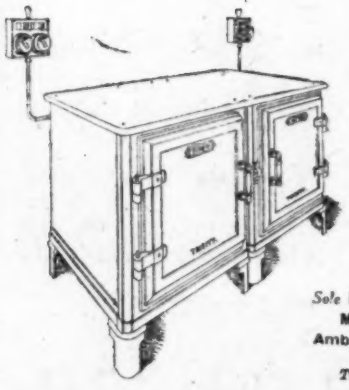

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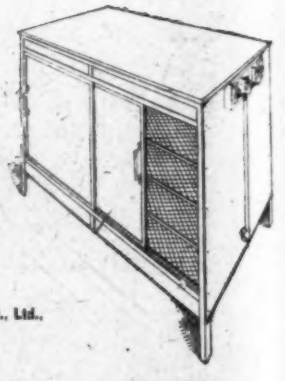

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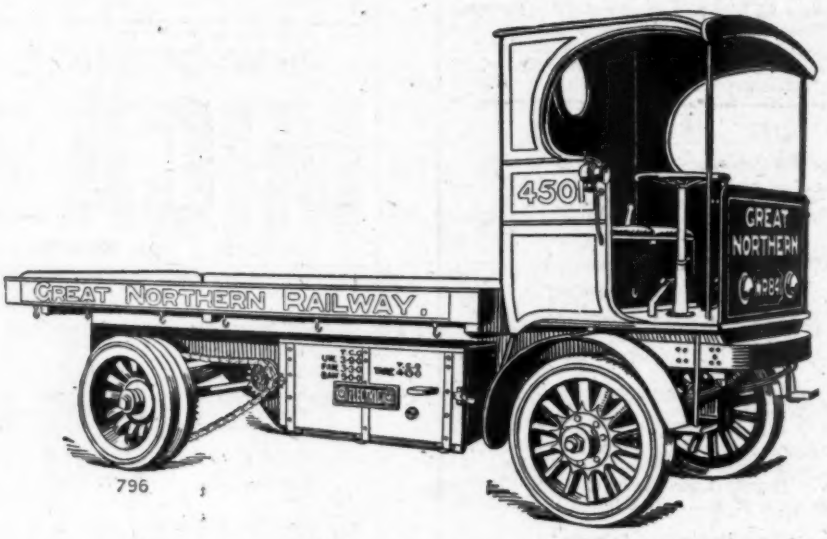

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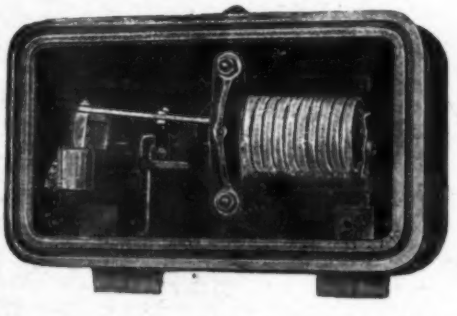

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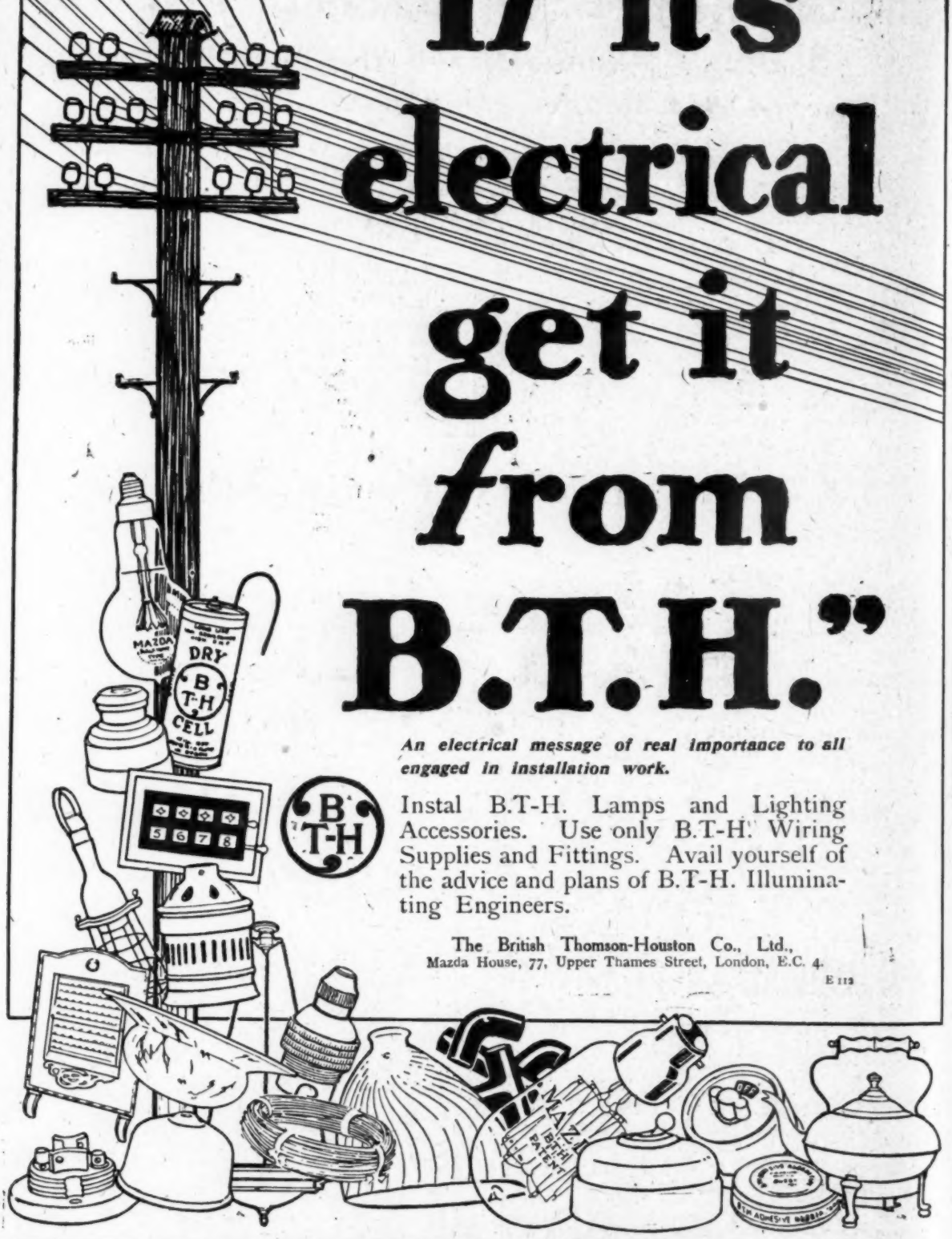

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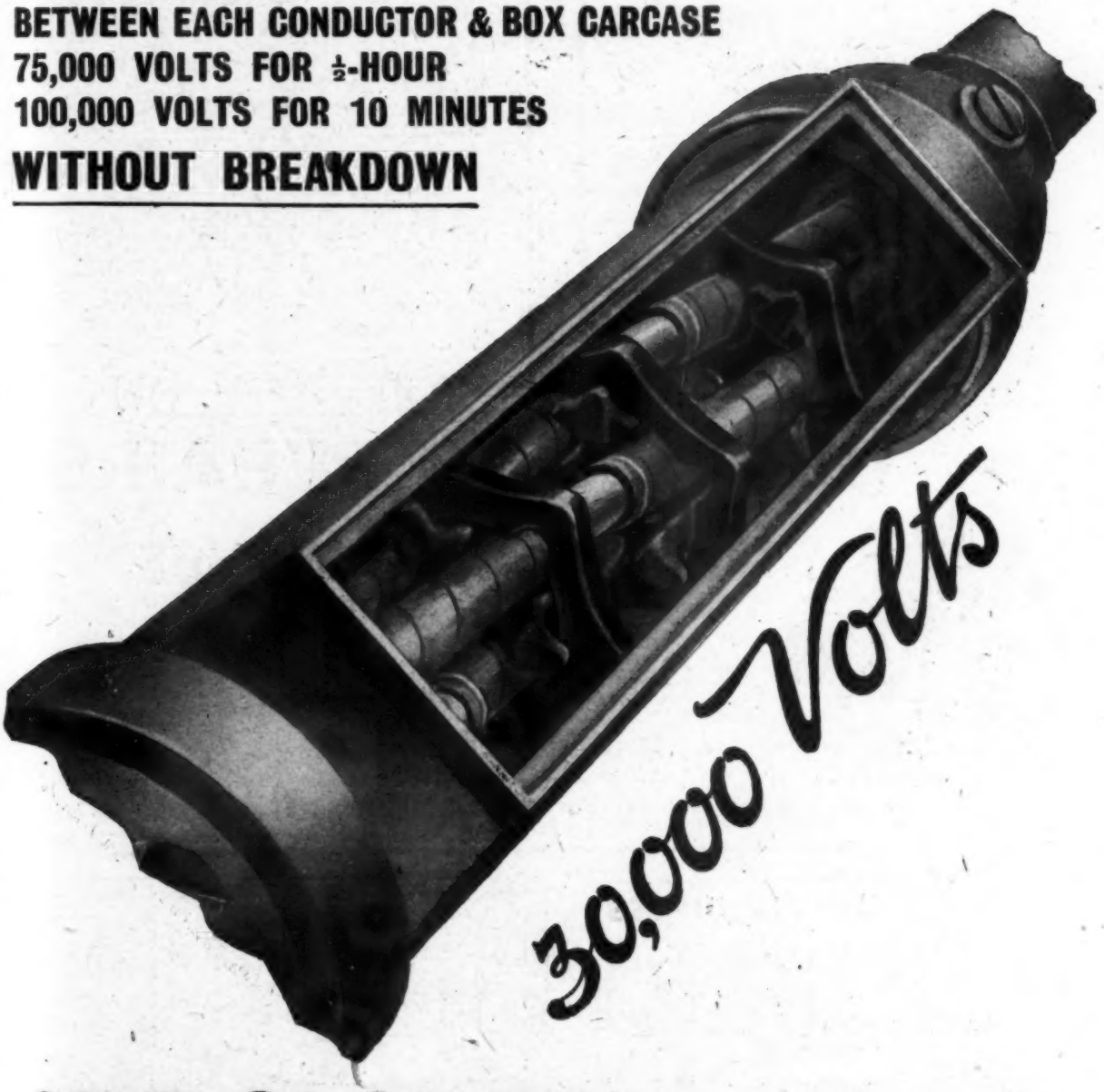

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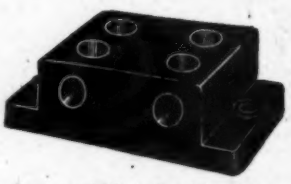

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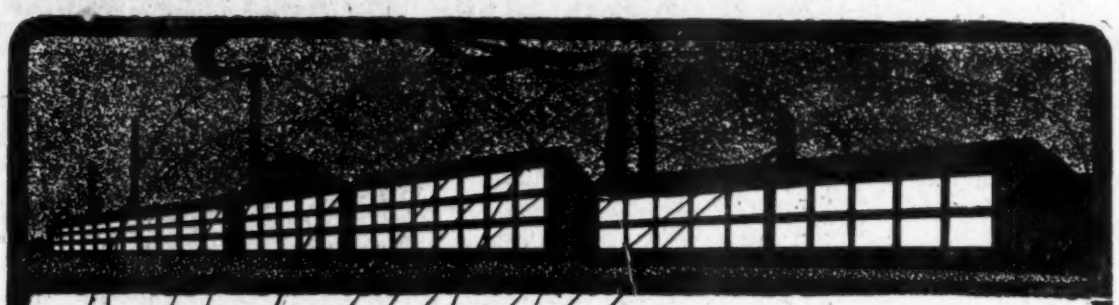
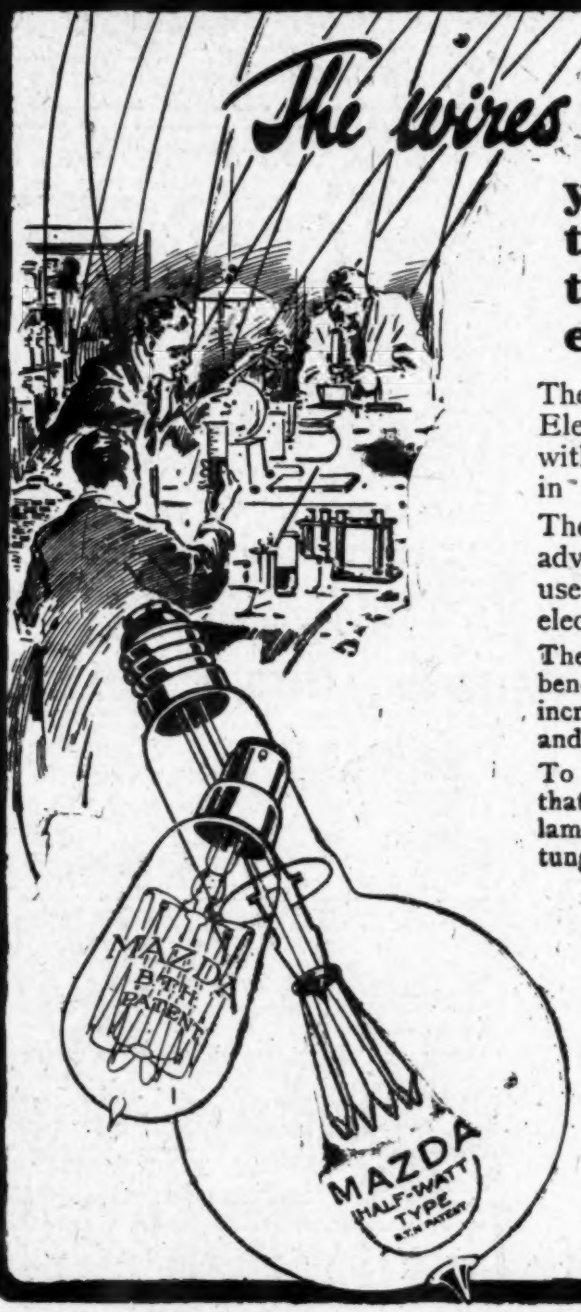


The wires that connect

your Works with the laboratories that revolutionised electric lighting..



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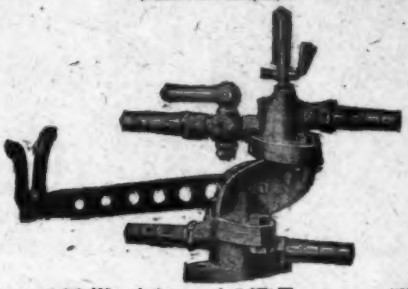

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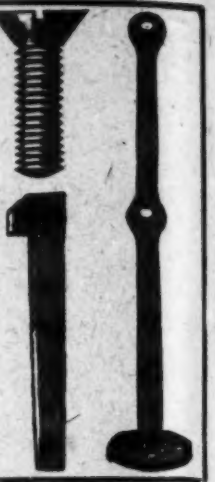

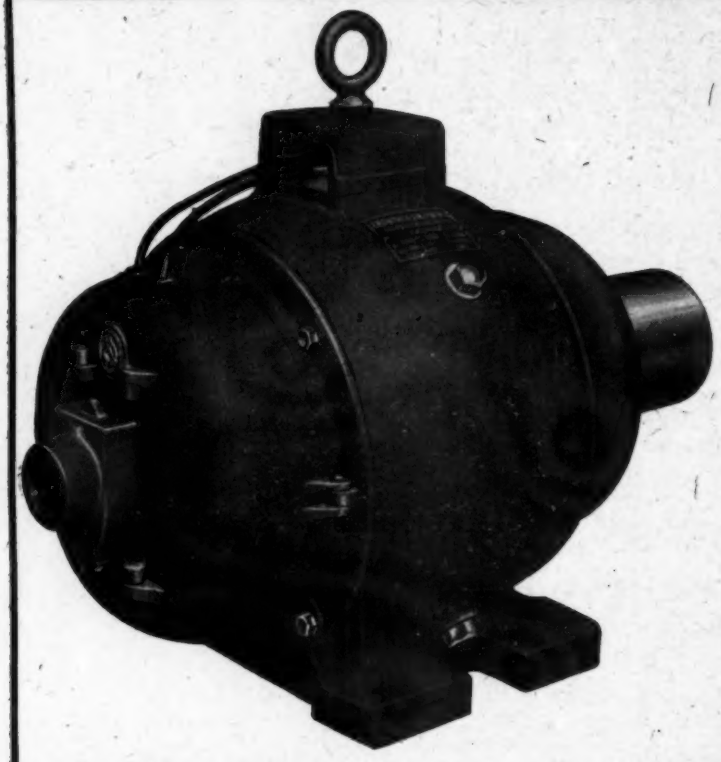

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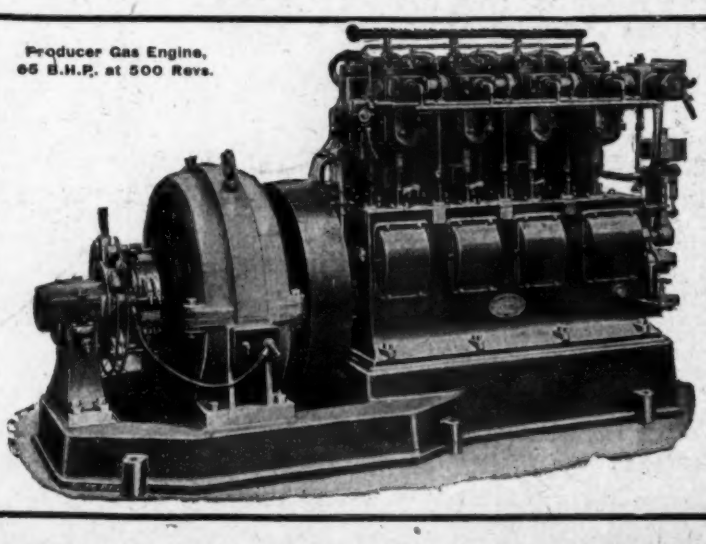

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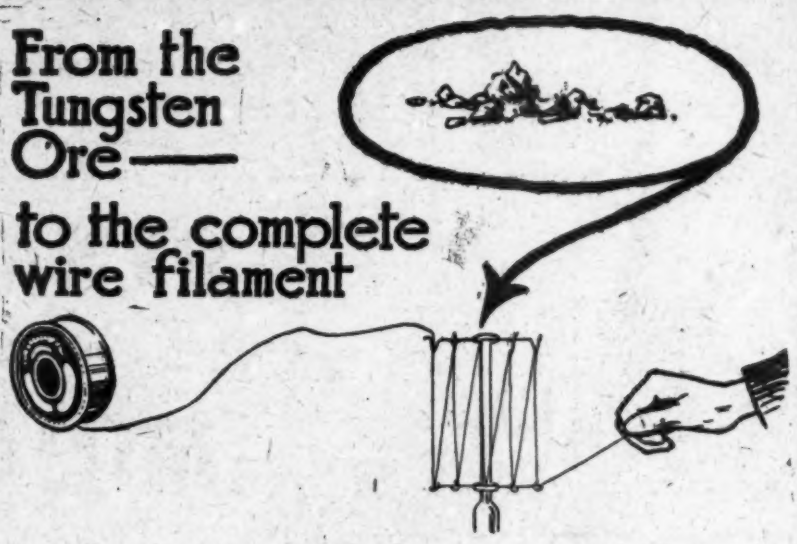

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96, Whitechapel, Liverpool.
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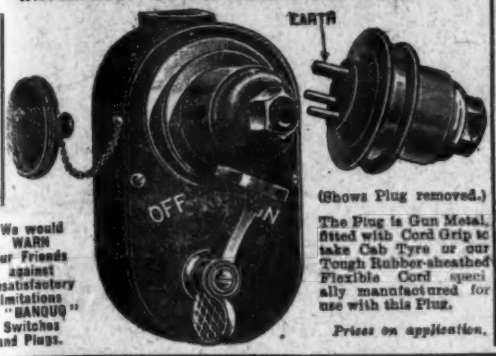

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This System will commend itself to engineers as an improvement on the practice of mounting a number of switches inside the same box as the fuseboard and in place of straggling single units. The switches are mounted on one iron base, this being usually fitted in proximity to the distributing fuse-box. The switches are foolproof, and saving is effected in cost and labour. The words "ON" and "OFF" are cast on the lid, and the switch handle is of cast gun-metal, giving a substantial yet neat appearance. The boxes can be drilled and screwed to requirements, and there is ample space inside cases for safety and ease in wiring.

WE CAN SUPPLY 'BANQUO' SWITCHES WITH LOOSE OR REMOVABLE KEYS, 1/4 per way extra.

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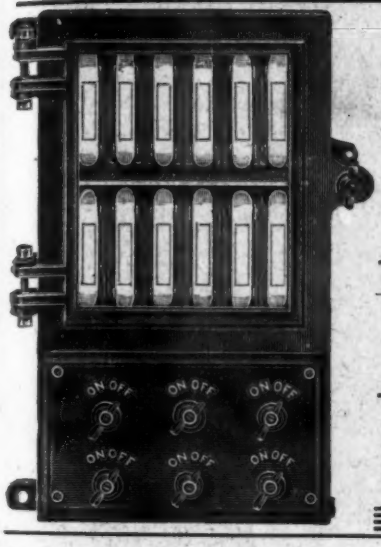

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An improved form of the very latest and best possible type. These boards have been supplied on the best class of work where low price has not been a consideration, but reliability and quality the only factors. The Fuses are our B.O.T. Sunk Type, and have all current-carrying metal parts totally protected. The Switches are made up in banks according to the desired number; they are in a dust and damp-proof compartment, with the handles on the front of panel.

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2	£1 8 0	£1 16 0
3	£1 6 0	£1 16 0
4	£1 5 6	£1 12 0
5	£1 5 0	£1 12 0
6	£1 4 0	£1 12 0
7	£1 4 0	£1 12 0
8	£1 4 0	£1 12 0

NUMBER OF SINGLE POLE 5-AMP. SWITCHES.

1.	2	3	4	5	6	7	8	9	10	11	12
5/0	9/4	14/-	18/8	23/4	28/-	32/8	37/4	42/-	46/8	51/4	56/-

Prices for Double-Pole and 10-amp. Switches on application.

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With Double-Pole China B.O.T. Replacement Fuses. Watertight.

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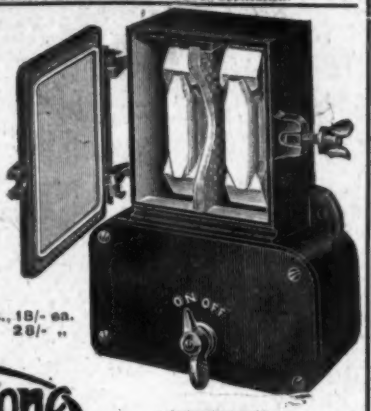
This makes up a useful set. The Fuse Lid is hinged and independent of the switch.

List A9/61, 5 amps., 18/- ea.
" A9/71, 10 " 28/- "



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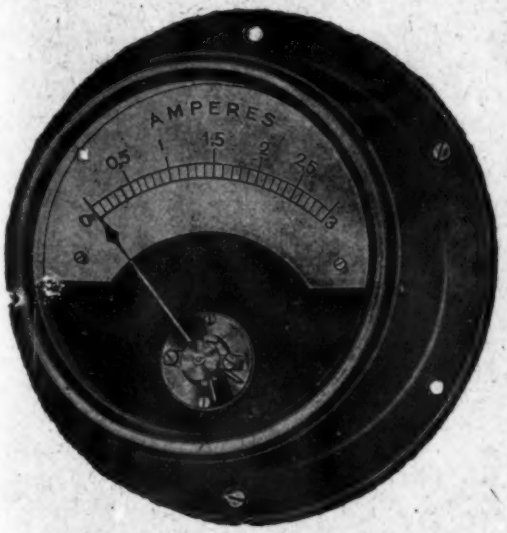

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AND IS WITHOUT DOUBT THE HANDSOMEST METER ON THE MARKET.

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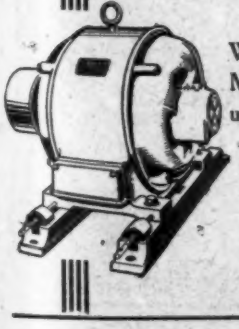
YOUR experience together with your reputation in your own particular speciality is your goodwill. So it is with us—all we are—all we have—and all we hope for, are bound up in our specialities, Single-Phase and Polyphase Motors for all industrial purposes where maximum power at a minimum current consumption is desired.

We have a very wide knowledge of this subject and our experience is available to all Power users whose propositions are such that we can assist. Will you add our experience to your own when planing extention and re-arrangements of existing plant?



We herein illustrate a Polyphase Motor. Many are in use and by the courtesy of the users may be inspected by arrangement.

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ENGINEERS,
Electrical Apparatus Makers,
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Telephone: Kensington 3761.

Interior o Messrs. Harrod's, Ltd., showing Osram Lamps in use with G.E.C. Fittings.

Printed by WILLIAM CATE, Ltd., 147-150, Saffron Hill, E.C. 1, and Published by the Proprietors, H. ALABASTER GATEHOUSE & KEMPE, 4, Ludgate Hill, London, E.C. 4.

Arklow.—Proposed E.L.—The U.D.C. has instructed Mr. Tierney, of Dublin, to prepare the necessary plans for the electric lighting of the town.

Australia.—New South Wales.—A scheme for the establishment of a wood pulping factory for paper making has been prepared by Dr. Earle Page, of Grafton (N.S.W.). The proposal provides for the installation of a hydro-electric power station, which is to utilise the water of the Clarence River at a point near Grafton.—*Tenders.*

E.L. Schemes.—The Coburg (Vic.) Council has been authorised to borrow £14,000 for the installation of an E.L. plant; the Kyogle (N.S.W.) Shire Council has applied for authority to install electricity within its area.—*Tenders.*

Batley.—Sewage Pumping.—It has been decided to substitute electricity for steam power at the sewage works.

Belfast.—Supply to Shipyards.—Four H.T. mains have been laid from East Bridge Street to Hamilton Road, and the supply of between 40,000 and 50,000 units per week to Messrs. Harland & Wolff has been commenced; the mains are nearly completed for the supply of a similar amount to Messrs. Workman and Clark. Work has been started on the new harbour generating station, and is proceeding satisfactorily.

Burnley.—After-War Extensions.—In reply to a request from the executors of G. Keighley for a supply of 650 H.P. after the war, the Electricity Committee states that it can give no definite reply until it knows what action the Government will take with reference to the after-war generation of electricity.

Chelmsford.—Price Increase.—The B. of T. has informed the T.C. that it does not propose to consider further the application of the E.S. Corporation for permission to increase the maximum charge to 9d. per unit.

Continental.—Spain.—A concession has been granted for the establishment of plant to utilise the water power of the river Najerilla, at Ventrosa (Province of Logrono), for the generation of electricity.

The Sociedad Hidroelectrica Iberica has started work on the establishment of a large hydro-electric station to utilise the power of waterfalls on the rivers Cinca and Cinqueta, in the north of Spain.

Belgium.—According to the daily Press, it was found during the work of clearing Zeebrugge harbour and works, that the Solvay electricity works were so little damaged that they could be set at work again in a fortnight.

Edinburgh.—Proposed Extensions.—At a meeting of the T.C. the Electric Supply Committee reported that the question of electricity supply had been urgently raised by the Leith Docks Commission in a representation to the Leith T.C., with regard to the increased supply required by the shipbuilding yards. A representative of the Ministry of Munitions reported that the need could be met, until the Portobello station was in operation, by the installation of a 5,000-KW. generating set, and an additional cooling tower at the Dewar Place station, and he urged that the plant should be ordered immediately. He estimated the cost of the plant at £47,000, and the mains at £23,000. The city electrical engineer considered that the cooling tower would not be necessary, and he estimated the total cost at £55,000.

Gillingham (Kent).—Electric Pumping.—The T.C. has decided to substitute electricity for steam for driving the deep water pumps, at a cost of from £150 to £200.

Halifax.—New Generating Station.—The T.C. has approved the recommendation of the Electricity Committee that the borough engineer be instructed to prepare plans, specifications, and estimates for buildings and plant in connection with the proposed power station at Copley.

London.—It is stated that the street lighting of the City cost £4,493 in the last quarter.

The fusing of some underground cables in Leicester Square on Thursday morning, last week, resulted in an explosion which blew the cover of a manhole into the air and caused a fire; the latter, however, was quickly extinguished.

Southwark.—The deficit of £8,144 on the past year's working of the B.C. electricity undertaking has been charged to the Borough Fund; the B.C. has secured the repayment of £2,179, representing income-tax paid by the electricity department during the past two years.

Lurgan.—Water Works Lighting.—The U.D.C. has resolved to proceed with the scheme for the erection of electric lighting plant at the water works, Castor Bay, Loch Neagh. Mr. Scheneid, Belfast, has been entrusted with the carrying-out of the work.

Newcastle-under-Lyne.—Price Increase.—The T.C. has applied to the L.G.B. for permission to increase the price of electricity beyond the present statutory maximum.

Rochdale.—National Electricity Supply.—The report of the B. of T. Committee on the future supply of electricity has been considered by the Electricity Committee and reported on by the borough electrical engineer; the Committee, being of the opinion that the scheme is vague and unconvincing, has recommended the T.C. to reserve its decision on the subject.

Reigate.—Mains Extensions.—The T.C. has decided to extend the electricity supply to two searchlight stations, at an estimated cost of £365.

Slough.—Questions and answers are given in last week's Parliamentary Papers with reference to the supply of electricity to the motor depôt, which is being constructed at Chippenham. Mr. Macpherson stated that the relative advantages of obtaining the electric power supply from the Slough and Datchet E.S. Co. and the installation of generating plant at the depôt at Chippenham had been most exhaustively considered, and it had been decided, for reasons of economy, to adopt the latter proposal.

Stafford.—Mains Extensions.—It has been decided to extend the electric mains from Gaol Road to the rear of Messrs. Dorman's works, St. Patrick's Street, at an estimated cost of £300.

Wages.—The T.C. has agreed to an increase of 3s. 6d. per week being paid to all men and women over 18 years of age in its employ, and 1s. 9d. per week to those under 18, such increases to date from October 1st.

Wakefield.—Prov. Order.—The R.D.C. has decided not to consent to the proposed prov. order of the Electrical Distribution of Yorkshire, Ltd., for the supply of electricity in the rural area.

Wigan.—Proposed Loan.—The B.C. has decided to apply to the L.G.B. for sanction to the borrowing of £5,000 for extensions in connection with the electricity undertaking.

Woking.—Price Increase.—The Electric Supply Co. has applied to the B. of T. for consent to increase the maximum charge for electricity to 8d. per unit.

Yarmouth (Isle of Wight).—Price Increase.—The Electric Supply Co. has increased the price of electricity to 9d. per unit.

TRAMWAY AND RAILWAY NOTES.

Accrington.—Wages.—An application of the National Transport Workers' Federation for the war wages of its members employed by the T.C. to be increased to 35s. per week to those over 18 years of age, and by half that amount to those under 18, has been forwarded to the Municipal Tramways Association, with a protest against the proposals.

Belfast.—The proposal to establish a tramway centre at Cromie Square has been referred back to the Tramways Committee for further consideration.

Continental.—France.—Railway Electrification.—The French Minister of Public Works states that the question of the conversion of the railways to electric traction, particularly on the systems of the Paris-Orleans, Paris-Lyons-Mediterranean, and the Southern Railways, is being investigated by the engineers of the Ponts et Chaussées. The inquiry is to ascertain the advantages to be expected from the electrification from the standpoint of the improvement in the means of traction, the reduction of the personnel and the economy in fuel from the proposed use of hydro-electric works. The results of the investigations will be centralised at the Ministry of Public Works, and be communicated to the engineers-in-chief entrusted with the schemes of utilisation of water power in the districts concerned, and a Committee has been appointed by the Chief Council of Public Works to draw up a plan for dealing with the railways.

Darlington.—Proposed Extensions.—The R.D.C. has decided to offer no objection to the application of the Darlington Corporation for a further extension of time for the extension of the tramways to Haughton-le-Skerne.

Coventry.—Accident.—Last week we referred to the tramway accident which resulted in the death of a passenger. It now appears that the Coroner's jury which inquired into the matter brought in a verdict, which the Coroner said amounted to one of manslaughter, against the driver of one of the cars, who will, consequently, be proceeded against.

Exeter.—Year's Working.—For the year ended March 31st last, the traffic receipts of the Corporation tramway department amounted to £20,629, an increase of £463 compared with the previous year, while the working expenses were £14,743, an increase of £1,804. After paying capital charges, the net profit was £1,516. 414,096 car-miles were run, a decrease of 18,964, and passengers carried increased by 42,662 to 5,306,362. Receipts per car-mile averaged 11·95d., against 11·17d. The energy used totalled 607,895 units, an average of 1·467 per car-mile, at a cost of 2·203d. per car-mile; last year 671,769 units were used, an average per car-mile of 1·551, at a cost of 2·327 per car-mile. The reserve fund, which the engineer states should, in his opinion, amount to at least £15,000, on account of the increased cost of renewals, stands at £6,849.

Llandudno.—Power for Railway.—The draft agreement between the U.D.C. and the Light Railway Co., in respect of a supply of electricity, has been referred by the Council to its Law and Parliamentary Committee for consideration.

Harrow.—Collision.—By a collision, on Wednesday last week, on the down line between two express goods trains between Harrow and Pinner, traffic on both lines to Marylebone, Baker Street and the City was entirely suspended until 8 a.m., when the up line was cleared, and both up and down trains were worked over the single line.

London.—Tube Fares Increase.—Certain fares and season-ticket rates were increased on November 1st on the District and all tube railways.

Preston.—Year's Working.—The annual report of the tramway department for the year ending March 31st last, shows that the receipts were £63,498, against £57,776; expenditure, £43,492, against £36,029; gross balance, £20,005, against £21,746; interest and income-tax, £8,291, against £6,863. The contribution to the rates was £5,500, against £3,750; sinking fund, £6,100, against £5,862. The car-miles run were 1,113,517, and the passengers carried numbered 15,455,163, being an increase of 1,645,974.

Thornaby.—Proposed Purchase.—The T.C. has decided to exercise its right of purchase of that part of the Imperial Tramways Co.'s system situated within its area, and to apply to the B. of T. for approval to notice being given to the company to sell.

United States.—Accident.—An accident, resulting in the deaths of 85 passengers, while twice that number were injured, occurred on Friday last week on the Brooklyn Rapid Transit Co.'s system at Brooklyn, New York. The accident occurred on the first day of a strike of drivers, owing to the refusal of the company to reinstate some discharged employés. The train left the rails at a sharp curve and ran into the wall of a tunnel, due, it is alleged, to the inexperience of the driver, who took the curve at too great a speed.

Yorkshire.—Electricity Charges.—Dewsbury Corporation and other authorities supplying power to Yorkshire (W.D.) electric tramways have been in conference to consider an increase in the charges for electricity supplied to the company.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—A Reuter message states that owing to certain suggestions which had been made regarding Mr. Jensen, Federal Minister of Customs, in the course of the investigations of the Royal Commission concerning the Navy Department's purchase of the wireless works at Randwick, while Mr. Jensen was Minister of the Navy, Mr. Watt, acting Prime Minister, has agreed to Mr. Jensen's request that he should be relieved of the administration of the Customs Department pending the completion of the investigations.

Empire Cable Communications.—An abstract of the Minutes of Proceedings of the Imperial War Conference, which was held in July last, has been published in the form of a Blue Book (Cd. 9177, 2s. net), and contains a report of the discussion on cable communications in connection with a resolution proposed by Sir Joseph Ward. The official announcement at the time stated that the Conference passed a resolution emphasising the need for telegraphic rates to be further materially reduced, but the actual resolution went much further. It reads as follows:—"That it is in the highest interests of the Empire that the rates for telegraphic communications between the United Kingdom, Canada, Australia, South Africa, and India should be further materially reduced as soon as practicable. That in order to ensure generally the cheapest and most secure telegraphic communication between the United Kingdom, Canada, Australia, and New Zealand, it is desirable that they should co-operate in the provision of a State-owned cable across the Atlantic." The importance of the latter part of the resolution, which commits the Governments concerned to the provision of a State-owned cable across the Alantic, is obvious. Sir Joseph Ward held the view that the State should also own the land-line across Canada.

Sweden.—Telegraphic communication between Malmo and Berlin, which had been suspended since the outbreak of war, has been resumed.

The Telephone Service.—London telephone operators have been given an advance of 3s. a week. Telegraphists and counter clerks whose wages do not exceed £1 8s. a week are to have 1s. a week more. A telephone operator will now start at the age of 18 with 19s. a week and rise in ten years to £1 11s.

Turkey.—Clause 12 of the terms of the Armistice provides that the Turkish wireless telegraph and cable stations shall be controlled by the Allies, Turkish Government messages excepted.

United States.—A new high-power radio station recently opened at Annapolis, Maryland, is one of the most powerful in the world. It was erected and equipped by the U.S. Navy in ten months; under pre-war conditions it would have taken two years. Its erection cost £300,000, and it is capable of maintaining communication over a distance of at least 4,000 miles. There are four steel towers, each 650 ft. high, supporting the antennæ, which, with the ground system, required 160 miles of wire for their completion. The power installation is in duplicate. The operation of the station requires the services of 100 men, all of whom are drawn from the enlisted force of the Navy. Suitable provision has been made for the protection of the station. The completion of the station gives still another guarantee of continuous communication abroad, even in the event of any possible interruption of the cable service.

Uruguay.—A Chicago company has presented a proposal to the Postal and Telegraph Department of the Government of Uruguay, for the installation of an automatic telephone service (subterranean) in the City of Monte Video. The proposal also comprises the construction of a new Central Post and Telegraph Office for the Government, the telephone installations to occupy the basement. The cost of the building and installations is estimated at $5,000,000 (Uruguayan), which sum it is proposed to amortise out of the proceeds of the telephone working.—*Review of the River Plate.*

Wireless in the War.—Dr. Lee de Forest, the inventor of the "Audion," states that all the U.S. airplanes are fitted with the apparatus, which has made it possible for the pilot to receive a message in the air despite the noise of the engine. The U.S. signal corps in the trenches are using a similar apparatus, which, by moving a switch, may be used for telephonic work, forming a valuable means of communication between artillery and infantry without the necessity of running wires. The French alone use 1,000 a day, and, up to date, his firm has made something like 200,000 for the American Signal Corps.

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdeen.—November 21st. Great North of Scotland Railway Co. Six or 12 months' supply of stores, including telegraph material. Stores Superintendent, 80, Guild Street.

Bedford.—November 13th. Two water-tube boilers, mechanical stokers, and induced-draught plant for the Corporation. See "Official Notices" October 4th.

Bradford.—November 23rd. Tramways Committee. Stores for 12 months, including lamp fittings, insulating material, &c. General Manager.

Enniskillen.—December 1st. Sligo, Leitrim & Northern Counties Railway Co. 12 months' supply of telegraph material. Mr. J. Duff, Secretary.

Walsall.—December 5th. Electricity Supply Department. One 500-kw. rotary converter equipment. See "Official Notices" to-day.

Warrington.—November 19th. Electricity & Tramways Committee. Underfeed mechanical stokers. Mr. F. V. L. Mathias, Borough Electrical and Tramways Engineer.

CLOSED.

Gillingham (Kent).—T.C.:—

Two electric motor vans for house refuse.—Edison Accumulators, Ltd., £1,068 each.

Manchester.—E.C. Annual tenders:—

A.C. meters and potential transformers.—British Westinghouse Electric and Manufacturing Co., Ltd.
Cable (extension to annual cable contracts).—C. Macintosh & Co., Ltd.; Western Electric Co., Ltd.; and Callender's Cable and Construction Co., Ltd.
Current transformers.—Ferranti, Ltd.

Redditch.—From the tenders received for the extension to the electricity works (Messrs. Handcock, Dykes & Trotter, consulting engineers), that of Messrs. C. G. Huins & Sons, at £4,195, has been accepted for the extension of engine and boiler house, and that, at £3,859, for the ferro-concrete work, overhead coal bunkers, ash tunnels, &c.

Reigate.—T.C.:—

Repairs to crankshaft, &c., of Diesel engine.—Mirrlees, Bickerton & Day, £915.

Stepney.—Electricity Committee:—

220 yd. of cable.—**W. T. Henley's Telegraph Works Co., Ltd., £179** (accepted); W. T. Glover & Co., Ltd., £184.

Wolverhampton.—T.C.—

Battery for electric vehicle, £145.—Chloride Co.
Steam-pipes for turbo set, £210.—J. Spencer, Ltd.
24-in. valve for water-pipe system, £63.—Alley & McLellan, Ltd.
Turbine platform and railings, £188 + £32 for contingencies.—Messrs. Gibbons.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, November 8th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Ordinary meeting.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, November 8th. At Westgate Road, Newcastle-on-Tyne. Paper on "Electric Welding," by Mr. W. S. Abell.

Birmingham and District Electric Club.—Saturday, November 9th. At 7 p.m. At the Swan Hotel. Paper on "Automatic Telephones," by Mr. H. W. Dippie.

Manchester Association of Engineers.—Saturday, November 9th. At 6.30 p.m. At the Grand Hotel. Paper on "Workshop Measurements, with special reference to Engineering Works," by Mr. W. F. Rogers.

Institution of Electrical Engineers (Western Centre).—Monday, November 11th. At Cardiff. Presidential address by Mr. C. H. Wordingham, C.B.E.

(Scottish Centre).—Tuesday, November 12th. At 7.30 p.m. At 207, Bath Street, Glasgow. Inaugural address by the Chairman, Mr. J. F. Nielson.

Junior Institution of Engineers.—Tuesday, November 12th. At 7.15 p.m. At the Mining Institute, Newcastle-on-Tyne. Paper on "The Design of High-speed Turbines," by Mr. M. Ward.

Friday, November 8th. At 7.30 p.m. At 39, Victoria Street, S.W. Lecturette on "Engineering in Connection with a Modern Kinema Show," by Mr. W. E. Dines.

Thursday, November 14th. At 2.30 p.m. Visit to Osram Robertson Lamp Works.

Friday, November 15th. Annual general meeting.

Industrial Reconstruction Council.—Wednesday, November 13th. At 4.30 p.m. At the Saddlers' Hall, Cheapside, E.C. Lecture entitled "A Retrospect from 1970" by Sir Arthur Steel-Maitland, Bart., M.P., Parliamentary Secretary to the Foreign Office and Board of Trade (Department of Overseas Trade).

Electro-Harmonic Society.—Friday, November 15th. At the Holborn Restaurant (Venetian Chamber). Ladies' night.

Institution of Mechanical Engineers.—Friday, November 15th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. General meeting.

NOTES.

Fuel Economy.—Mr. C. F. Spencer, the Director of National Kitchens, has ascertained through his technical advisers the average consumption of fuel in households to supply a family of five persons with a mid-day meal, and the consumption of fuel in a National Kitchen to supply the same number of people with a similar meal. The position is illustrated in the following statement of quantities used :—

Cooked at home.	Cooked at a National Kitchen.
15 lb.	5 lb.

It is estimated that in the National Kitchens throughout the country 1,000,000 portions of food are sold daily, to cook which approximately 178 tons of fuel are used. These portions represent the equivalent of meals in 80,000 households of five persons each. To cook the same quantity of food at home would require 534 tons of coal. The annual saving (excluding Sundays) is therefore 111,428 tons.

If 100,000 additional families decided to take three meals per week at a National Kitchen, the annual saving in fuel, on the above basis, would be a further saving of over 100,000 tons. It is thus clear that an enormous saving in coal would be effected if, instead of each household cooking its own meals, they were obtained at National Kitchens. In the above analysis it is assumed that households will be in a position to obtain all the coal they require. With the severe rationing now in force, this will certainly not be the case; therefore, it is essential that municipalities and other local authorities should consider seriously the establishment of National Kitchens.

An I.M.E.A. Protest.—According to *The World*, the Council of the Incorporated Municipal Electrical Association has thus circularised all Members of Parliament :—"The Council of the Incorporated Municipal Electrical Association, representing practically the whole of the electricity supply undertakings in Britain, view with grave concern the lack of uniformity of treatment at the hands of the Government Department concerned in granting permits for power station and plant extensions of large electricity supply undertakings, and respectfully request that impartiality be shown when deciding future applications for necessary extensions of electricity supply schemes. It is felt that the success of the scheme of the Board of Trade for the reorganisation of the electricity supply industry is being seriously prejudiced by the close connection between the principal staff of the Ministry of Munitions and large private electricity undertakings in the country."

Pulverised Coal.—In its endeavour to improve boiler-room efficiency, the Milwaukee Electric Railway and Light Co. has been investigating recently the possibilities of pulverised fuel. On a 468-H.P. water-tube boiler a gross efficiency of 85·22 per cent. and a net efficiency of 81 per cent. were obtained. The results of the experimental work, which was conducted at the Oneida Street plant, are given in *Power* for October 15th :—

An evaporation from and at 212° of 9·47 lb. of water per lb. of coal was obtained. The average temperature of the feed water was 157·2° F., the operating steam pressure 167 lb. gauge, and the superheat 74·9° F. The fuel used was screenings of three different varieties. The B.TH.U. in three lots of coal as received averaged 10,779 and the B.TH.U. dry 12,045. A noticeable feature was the small amount of draught required. There was, of course, no fuel bed, and the drop through the boiler when using a relatively small volume of air was practically negligible. In the combustion chamber and the first pass the vacuum was practically nil; it could not be read on a gauge calibrated to 0·01 in. In the second pass the draught was 0·0057 in. and at the uptake 0·0975 in. It was noticeable that there was no accumulation of slag on the tubes, no pulsation, and that the brickwork was not affected by the heat of combustion. The deductions made for fuel preparation are interesting. Under the drier 1,140 lb. of coal was burned. The power requirements for the pulverisers, the various conveyors, the feeders, and the fans were 449·3 KW.-hours, reducing on a basis of 3 lb. of coal per KW.-hour to 1,348 lb. of coal. The total deduction, then, was 2,488 lb. of coal, which, at $5 per ton, would amount to $6·22. As 24 tons of coal were used in the test, the fuel value for preparation reduced to 26 cents per ton.

With coal at $5 per ton it was estimated that the gross efficiency shown by the pulverised-fuel boilers would have to exceed that shown by the mechanical stoker-fired boilers by 6 per cent. to offset the coal preparation costs.

The gain in efficiency was only a part of the advantages resulting from the use of pulverised fuel. Other advantages were summarised as follows :—Continuous boiler operation at a uniform rating as well as constant efficiency. At no time is there a loss in capacity due to the clinkering of coal on grates or cleaning fires, nor are difficulties experienced from a change in the fuel as it comes from the bunker, necessitating different operating conditions at the stoker. Heavy overloads can be taken on or dropped off in an unusually brief time through the adjustment of the coal feeders and the furnace draught. From 97 to 98 per cent. of the combustible in the coal is utilised regardless of the quality of the fuel. The ash-handling costs are reduced to a minimum due to the reduced volume. When operating with pulverised fuel, the banking conditions are somewhat different from those obtained in stoker practice. By stopping the fuel supply and closing up all dampers and auxiliary air inlets, a boiler can be held up to pressure for at least ten hours. To illustrate, when running one of the preliminary tests the boilers had been shut down at 9 o'clock at night with 175 lb. steam pressure, and at 7 in the morning there was still 155 lb. pressure, and the brickwork was hot enough to ignite the coal from the burner. In stoker practice it is necessary to leave the damper slightly open to supply air and prevent gas explosions, so that much of the heat in the banking coal and from the brickwork passes up the stack rather than into the boiler.

The ease of controlling the fuel feed and draught, the ability to take on heavy overloads in a brief time, the thorough combustion of the coal, and the uniform high efficiency obtainable under normal operation make pulverised coal a satisfactory form of fuel for central station use. For operation month in and month out it is stated that pulverised fuel would show a net gain of 10 per cent. over the previous ways of operation. As to maintenance, indications were that no unusual difficulties would be encountered. One predominant factor justifying the use of pulverised fuel was the ease with which a high efficiency could be obtained and the constant nature of that efficiency. There was little doubt that with a well-equipped plant burning pulverised fuel, and having all the necessary recording and indicating instruments to guide the operator in maintaining proper conditions, a lower cost of generating steam would be possible than has heretofore been attained with any type of equipment.

Miners' Electric v. Oil-flame Lamps.—At a meeting of the Scottish Branch of the National Association of Colliery Managers at Glasgow, last month, the Branch-Secretary read a communication from Prof. Robert Laverick, of the Notts. Branch, explaining that the Safety Lamp Committee desired to include in its report some statistics upon miners' nystagmus, and would be grateful if the Scottish Branch could furnish any particulars as to the effect produced by changing from oil-flame to electric safety lamps. The Branch-President said that his experience had gone to show that the men in his colliery, although they had some few complaints regarding the electric safety lamps, preferred to use them rather than the oil safety lamp. He had had electric lamps in his colliery for two years, and not a solitary case of miners' nystagmus had been reported in that time. The electric lamp required closer supervision, but he did not think managers would grudge that, because it was compensated for by the better illumination. Other speakers expressed similar views.

Mr. Wm. Wilson (Glasgow) remarked that even with his limited experience of such lamps he certainly would never think of abandoning them for the oil-flame lamp. The great majority of the men appeared to think oil-flame lamps were more troublesome than the electric lamp, and they preferred the latter because of the pronounced superiority of its light. Mr. D. C. Gemmell said they had a mixed system of lights at his colliery, and once the electric lamps had been installed they had great difficulty in getting the miners to revert to the oil-flame lamp. He had found that the electric lamp was cheaper in maintenance than the oil-flame lamp. Mr. James Boyd (Kilsyth) suggested that the Branch-President should give them a paper on the comparative merits of oil-flame and electric lamps at some future meeting. The consensus of opinion among those present was that, so far as Scotland was concerned, the use of electric lamps had not aggravated nystagmus amongst Scottish miners.—*Iron and Coal Trades Review.*

Electrical Engineers on Board Ship.—Referring to the new scale of wages for sea-going electricians published in our last issue, the Electrical Trades Union informs us that it has been trying for a considerable period to improve the material conditions and status of men engaged as electricians and electrical engineers on board ship. As a result of a meeting with the Maritime Board some few months ago, the new rates were agreed to by that Board

A New St. Lawrence River Dam.—Authority is to be given to the St. Lawrence River Power Co. to construct a submerged weir in the South Sault Channel of the St. Lawrence River near the entrance of the company's power canal leading to the power house at Massena, N.Y., says the *Electrical World*. The Dominion Government insisted that building the weir would interfere with navigation in the channel, in contravention of the provision of the Webster-Ashburton treaty; also that it was against public interest to permit such work to be done by private corporations, inasmuch as the control of the water level of the river would pass from international territory to the power house at Massena. It was pointed out by the United States War Department that the erection of the weir was necessary to increase the output of aluminium for war purposes, and the president of the Aluminium Co. of America said that increased production of aluminium could not be secured at any other point. He wanted the dam for war purposes during the war and to prevent interference by ice with the ordinary production after the war. The State of New York maintained that title to any structures in the St. Lawrence River should remain in the State of New York, and that while there would be no objections to grant permits for the duration of the war, the State was opposed to a permanent hindrance to navigation of the South Sault channel. It was intimated by the Dominion Government that if the commission granted the application, the Canadian Government would at once request the United States Government to guarantee that the weir would be removed upon request at any time after the war. Formal protest would also be made against the present diversion of water through the St. Lawrence River Power Co.'s power canal and against any possible future increased diversion.

Copper for German Industry.—One of the various reasons adduced in Germany for the desired return of that country's former colonial possessions lies in the deposits of copper in South-West and East Africa and New Guinea, whilst at the same time eager glances have been directed towards the mineral riches in the Belgian Congo. It seems quite a grievance to Christian Pfrank of the Oriental Seminary of the Berlin University, that with a domestic copper production of only 39,000 tons in 1912 Germany was compelled to import 200,000 tons in order to assist in meeting the total consumption, and that 85 per cent. had to be procured from the United States at the prices arbitrarily fixed by American producers. Although the copper deposits in South-West Africa had only been slightly opened up prior to the war, it is considered that they would be able, in the course of time, to meet a considerable portion of the German home demand for copper, and thus break the monopoly of the United States. The copper ore deposits in the Katanga district of the Belgian Congo are said to be enormous, and C. Pfrank states that "with such a possession we could cover our whole requirements within a not distant period, and consequently provide our important electricity industry with its thousands of workmen with an assured position for ever." This is surely an intimation of what the Belgians might have to expect if the Germans were ever permitted again to become established in Africa. It is contended finally that the Germans could only liberate themselves from paying tribute to the United States for copper by possessing their own colonies with rich copper deposits, and that therefore no peace should be agreed to without the return of German South-West Africa. It is highly probable that the Germans will reach a different conclusion before very long.

The Development of 2,500-Volt Fuses.—Mr. R. C. Cole gives an interesting *résumé*, in the *Electrical World* of September 7th, of the struggles of one enclosed fuse maker in overcoming the difficulties of the situation, and producing a safe and reliable fuse for circuits of as high a pressure as 2,500 volts. The author sets out the properties that the various component parts of the fuse should possess, and an historical survey of the early types of fuse is given. A large number of experiments were conducted to determine a method of preventing strip corrosion and breakage; to discover a heat-dissipating material embodying all of the essential characteristics required, and to determine the proper arrangement of the strips composing the fusible element. The investigators were finally fortunate in discovering a material most admirably adapted to quench the arc. Owing, however, to the fact that its behaviour under short-circuit conditions was not all that could be desired, a double-filling material scheme was determined upon, placing the material best adapted to quench the arc in the centre of the tube and using a calcium-carbonate sulphate combination at either end. New fluxes were compounded to prevent any corrosion of the strips in soldering, and a special low-melting-point alloy was devised to solder the strips to the star-shaped terminals. Overload tests were made at 150 per cent. current on hot fuses, this being the most severe condition under which a fuse could be called upon to operate. The fuses were heated by a low-voltage current for a sufficient length of time to bring them up to the maximum temperature and immediately thereafter were subjected to the overload at 2,400 volts. The final fuses resulting from the experiments operated, it is stated, without the slightest exterior manifestation under extreme conditions of overload and short circuit. The amount of metal dissipated as a result of the short-circuit condition was only very little more than that under the overload condition. This is accounted for by the fact that the new filling material is capable of condensing instantaneously the metallic vapour formed upon the disruption of the link before the arc has an opportunity to extend more than three-quarters of an inch.

Electric Resistance of Porcelain and Magnesia.—All insulators fail more or less at high temperatures, and porcelain spark plugs show noticeable current leakage at 1,000 deg. C. Mr. P. H. Brace described some new experiments on the resistivity of magnesite and porcelain before the May meeting of the American Electrochemical Society. According to *Engineering*, he tried magnesite, of 94 per cent. of MgO in two forms, in test blocks of 1 in. by 0.8 in. The magnesite was either used after electrical fusion, or it was fused, then crushed to powder, moulded under heavy pressure, and baked at 1,700 deg. The test pieces were placed between nickel grids and loaded with 11 lb., layers of asbestos being applied on the outside of the grids; the specimens were heated up to 1,000 deg. C., cooled quickly, and reheated to various temperatures during the resistivity tests with continuous currents at 120 volts or alternating currents. The resistivity appeared to be a function of the time during which the current was applied; the final resistance observed was greater, several times greater frequently, than the original resistance. This change was greater with magnesite than with porcelain, and magnesite had a higher resistance than porcelain at the same temperature. The moulded magnesite gave on the whole lower resistance values than the merely fused material, possibly because the grinding had introduced small impurities. In all cases some evidence of electrolysis was obtained, the resistance first falling and then rising again on reversing the current. This was particularly noticeable in hot porcelain at 910 deg. and 990 deg. C.; porcelain, in fact, behaved like an accumulator, giving for half an hour or so a counter electromotive force of 0.7 volt.

Fined for Stealing Electricity.—Arthur Ernest Briggs (36), fitter, Moldgreen, was fined £10 at Huddersfield for stealing 16 units of electricity, of the value of 6s. 8d., the property of the Huddersfield Corporation. According to the *Yorkshire Observer*, Capt. Moore (Chief Constable) said that in June last year the accused had his electrical supply cut off for the non-payment of his bill. After a police constable had observed electric light burning in the house it was found that the accused had broken the seals, connected the fuses, and tampered with the meter. The indicator showed that 16 units had been consumed since the mechanic had disconnected the supply.

Appointments Vacant.—Shift engineer, 73s. 6d., for the Dewsbury Corporation Electricity Department; charge engineer, for the Yorkshire Electric Power Co. See our advertisement pages to-day.

Plans for Demobilisation.—The *Manchester Guardian* publishes the following:—The machinery for the demobilisation of the Forces and of war workers in civil life is very far from complete, but during the last week or two the Ministry of Labour has issued some details of its plans. This week these have been laid before the Advisory Committee (of which Sir David McCabe is chairman) which covers Manchester, Salford, Eccles, Altrincham, Stretford, Swinton, and Pendlebury, and their local bearing has been considered. The scheme, as it affects the soldier, is really an extension of the present methods of placing discharged men back in industry. Some weeks before demobilisation the soldier will be asked to fill up a form stating whether he has a definite promise, or the prospect, of reinstatement by his former employers. "This form will be sent by the Army authorities to the Employment Exchange in which area the man intends to reside, so that arrangements may be made to place him. In preparing drafts for release regard will be had to the urgency, from the national point of view, of particular trade requirements. Preference will be given to men who have a definite promise of a job. Employers, it is expected, will have an opportunity of applying for the release of individuals—especially key or pivotal men. As far as practicable, married men, or men with long Army service, will be given preference. Free unemployment insurance policies, valid for one year from the date of discharge, will be issued, though the rate of payment and the governing regulations have yet to be determined, and must form the subject of a Bill. The demobilisation of munition workers will follow much the same lines of procedure. Employers will be supplied with registration forms for distribution to their workpeople before discharge. On these the workers will state whether they have a promise of engagement, or a desire to return to their former employer. When complete, the forms will be returned to the Employment Exchange. One of the most important sides of demobilisation and reconstruction schemes will be the collection of facts about industrial prospects and conditions. Information will be gathered, and account taken, of the number of workers likely to be required by particular industries, including new trades; the number of men likely to be returned from the Forces; the number likely to be reinstated by former employers; the industries which are to be given priority; the use to which national factories, dockyards, and other war establishments are to be put; the quantities of raw material available; the work to be put in hand to meet public and industrial needs, and the housing need of each locality after the war."

Volunteer Notes.—Royal Engineers (Vols.), London Army Troops Companies.—Headquarters: Balderton Street, Oxford Street, W. 1.

Captain of the Week.—Capt. E. G. Fleming.
Next for Duty.—Capt. W. Hynam.
Sunday, November 10th.—Commandant's Parade at Waterloo Station, for work at Esher, 9 a.m. Drill order and great coats. Mid-day and tea rations to be carried. "Demolitions."
Monday, November 11th, to Saturday, November 16th.—Drills as usual.

C. Higgiss, *Capt.* R.E., *Adjutant.*

Patents and Alien Enemies.—Application has been made to the Board of Trade to avoid or suspend Patent No. 23,319/07, granted to Hartmann & Braun Akt.-Ges., for frequency meters, by Messrs. Johnson & Phillips, Ltd.

Water-power Survey in India.—Replying to Colonel Yate in the House of Commons, the Secretary of State for India said that the Government of India had decided, before constituting a Committee, to appoint an experienced engineer to report on the possibilities of promising sites as regards storage and power development. They had associated with him an electrical expert. At the same time, information would be collected regarding industrial possibilities within reach of promising sites; and the terms for the grant of concessions would be considered in consultation with local Governments.

The *Times* states that the Indian Government is considering making a systematic survey of water-power resources for the generation of electrical energy, with the object of rapid industrial development after the war.

Fatality.—The *Leeds Mercury* states that Ezekiel Pickles (50), fitter's labourer, of Barugh, has been killed through his hand coming in contact with a live wire at the works of the Smokeless Fuel Co., near Barnsley.

Institution and Lecture Notes. — Electrical Power Engineers' Association.—A meeting of the local members of the Association was held at the Grand Hotel, Bristol, on Friday evening last, under the chairmanship of Mr. A. J. Ostler (Substation Superintendent, Bristol Corporation Electricity Department). The following gentlemen were elected to act as a temporary Committee:—Messrs. A. J. Ostler, S. Hotchkiss, T. F. Wells, E. P. Kelly, and F. J. Elliott (hon. secretary). This Committee was entrusted with the arrangements for a mass meeting of engineers engaged in the production, transmission, distribution, and utilisation of electrical energy, to be held at Bristol this month. At that meeting it is proposed to inaugurate a Local Section of the E.P.E.A., and the Hon. Secretary, whose address is 3, Glenn Avenue, Knowle, Bristol, will be pleased to receive and reply to any inquiries in connection therewith.

Liverpool Engineering Society.—The first meeting of the new session was held on Wednesday evening, when the President (Prof. J. Wemyss Anderson), delivered his inaugural address. The syllabus includes the following:—

November 20th.—A. E. Berriman, O.B.E., "Education in Relation to Industry, with Particular References to Engineering."
December 4th.—R. W. Allen, "Air Supplies to Boiler Rooms."
December 18th.—H. S. Rowe, B.Sc. (Lond.), "The Growth and Arrangement of Industrial Boiler Plants."
(Joint meeting with the Society of Chemical Industry.)
February 5th.—E. A. Atkins, "Electric and Oxy-Acetylene Welding and their Defects."
(Joint meeting with the Society of Chemical Industry.)
February 19th.—J. Purves, "Boiler Mountings."
April 16th.—John A. Davenport, "Welfare Work."

Greenock Association of Electrical Engineers.—The new session opened on October 10th with the presidential address of Mr. G. M'Donald on "Problems Confronting the Electrical Industry After the War"; last night (Thursday) a paper was to be read by Mr. G. Reid on "Electrical Thoughts." Other events in the programme for the session are:—

November 30th.—Visit to Coats's Observatory, Paisley.
January 9th, 1919.—"An Hour with Ultimate Electricity," P. C. Kerr.
January 25th.—Visit to Messrs. A. F. Craig & Co.'s Engineering Works, Paisley.
February 6th.—"Some Notes on the Cabling of Public Works," W. R. Scott.
February 22nd.—Visit to Brown & Polson's Corn Flour Works, Paisley.
March 6th.—Junior night and general meeting.

Bradford Engineering Society.—A lecture was given on Monday last by Mr. T. H. C. Homersham, of Thwaites Bros., Ltd., Bradford, on "Electric Furnaces for the Manufacture of Steel." The lecture was illustrated by lantern slides of the works of the firm.

Institution of Civil Engineers.—The opening meeting of the 100th session of the Institution was held on Tuesday, when Sir John A. F. Aspinall delivered his presidential address, after which he presented medals awarded by the Council for papers read and discussed during the past session. The president mentioned the desirability of bringing the various engineering institutions under one roof, sharing one common library, and hoped, if such a project were realised, that Westminster would become the headquarters. The address took the form of a review of British railways; Sir John explained the present situation, and indicated how and where reforms could be made. He stated that wireless telephony had been developed to such an extent that it would probably enable heavier goods trains to be hauled by the use of two locomotives, one in front and one at the rear, and both drivers and guard would control the train by wireless telephony. The railways would undoubtedly consume much electricity in the future; but electrification would be confined to suburban rather than main lines. It was a fact that wherever suburban lines had been electrified, the passenger traffic had greatly increased, due to the increased number of trains and the shorter time taken to do the journey. With regard to the proposed super-power station scheme, he said that the question which had to be settled was whether it was more economical to place the station on the coalfield or at the load centre. In other words, was it cheaper to transmit electric power from the station along long lines of copper, or to carry coal to the station along long lines of railway?

"The Electric Furnace in the Metallurgy of Iron and its Alloys" was the subject of a lecture by Mr. H. Etchells, at the Applied Science Department of Sheffield University, on Saturday evening, in connection with the Sheffield and District Section of the National Association of Industrial Chemists. The lecturer mentioned the peculiar properties of electricity as the source of energy for metallurgical purposes, and showed how the experiments of Sir William Siemens and Henri Moissan directed attention to the unexplored possibilities of electricity as a metallurgical instrument. He pointed out that in countries where coal was plentiful the development of the electrical furnace had not received such an impetus as in those countries where coal was scarce, but water power was readily available. Mr. Etchells showed that the fuel value of electricity was such that if the electric furnace was to compete on a fuel basis alone it would be quite outclassed by any process which gave a heating value directly from coal of more than, say, 7 per cent. efficiency, because, although electric power in itself was highly efficient, losses which occurred in converting the energy of coal into electricity were abnormally high. He described various types of furnaces used in steel working, showing the differences in principle of the various types. Reference was made to the new developments in electric resistance furnaces. Mr. T. F. Russell, chairman of the Sheffield and District Section of the Association, who presided, announced that the Employment Bureau in connection with the National Association of Industrial Chemists was now in full working order.

The Siemens Companies.—On Tuesday last Mr. Justice Astbury, in the Chancery Division, commenced the hearing of three actions in which Siemens Bros. & Co., Ltd., and Siemens Bros. Dynamo Works, Ltd., were concerned. The cases related to the rights of shareholders and the splitting of shares. We shall refer to the matter more fully next week.

Post-War Priority.—A Standing Council on post-war priority, to which we referred in "War Items" last week, has been appointed to assist the Cabinet Committee, and is now at work. The Council has already had before it a survey of the existing stocks of the more important raw materials, and is giving urgent consideration to the question of releasing such materials from any form of control at the earliest possible moment. It is the intention of the Council to consult the trade bodies concerned with regard to any matters affecting the industries they represent, and, by taking them into its confidence, to make the utmost possible use of their organisations in any allocation of materials which may be found to be necessary.

The personnel of the Council is not yet complete. The following are the members already nominated:—

President: Dr. Addison, M.P., Minister of Reconstruction.
Chairman: Sir Henry Birchenough.
Members: Sir Kenneth Anderson, Orient Steam Navigation Co., Ministry of Shipping; Mr. H. R. Armitage, Bradford Dyers' Association, Manchester; Mr. J. T. Brownlie, A.S.E.; Colonel Byrne, Secretary War Priorities Committee; Mr. J. Carmichael, contractor, Wandsworth, S.W.; Mr. J. H. Clapham, Board of Trade; Sir Sydney Henn, Director of Priority, Army Contracts Department; Mr. W. J. Larke, British Thomson-Houston Co., Rugby; Sir Peter McClelland, Duncan, Fox & Co., London; Sir Herbert Rowell, R. & W. Hawthorn, Leslie & Co., Newcastle; Sir David Shackleton, Secretary Ministry of Labour; Mr. Wallace Thorneycroft, Lochgelly Iron and Coal Co.; Mr. Alexander Walker, John Walker & Sons, Kilmarnock; Mr. J. Wormald, Mather & Platt, Manchester.
The joint secretaries are Mr. T. R. Gardiner, Ministry of Reconstruction, and Major G. D. Hazledine, Board of Trade.

Communications should be addressed to the Joint Secretaries, Standing Council on Post-War Priority, 2, Queen Anne's Gate Buildings, Westminster, S.W.

Lancashire and Cheshire Wages Award.—As a result of arbitration proceedings, workers in electricity undertakings in a number of towns in Lancashire and Cheshire are to receive an advance of 3s. 6d. per week, with 1s. 9d. per week for boys and youths under 18 years. The award is made retrospective to August 10th.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—On the occasion of his retirement from the position of station superintendent at the Croydon electricity works, Mr. D. Cowan was presented with a gold ring and a gold pendant, with an umbrella for Mrs. Cowan. Mr. J. H. Parker, the assistant borough electrical engineer, made the presentation.

Mr. D. Macdougall, electrical superintendent at the Greenock Corporation electricity works, has been appointed assistant engineer at £400 per annum.

Mr. Oscar Parker, who has been filling a post at Newton Abbot (Devon), has resumed his duties at Lincoln municipal electricity works.

There were 30 applications for the position of chief engineer to the Darwen electricity works at £300 per annum.

The Gillingham (Kent) T.C. has increased the salary of the electrical engineer by £100 a year to £400, including war bonus.

The Erith U.D.C. has accepted the resignation of Mr. J. H. Seymour, the deputy electrical engineer. Mr. Taylor, charge engineer, has also resigned. Messrs. Weston (Southall) and Kettle (Tunbridge Wells) have been appointed charge engineers, and the system of eight-hour shifts is to be re-established.

Mr. W. B. Smith, Greenock, who was recently appointed Corporation electrical engineer at Paisley, has been presented with a mahogany clock by the staff of the Greenock Corporation electricity department. Mr. F. H. Whysall made the presentation.

Stepney B.C. General Purposes, Staff, and Education Committee recommends that in lieu of the borough electrical engineer and manager's (Mr. W. C. P. Tapper) salary and war bonus of £1,080 per annum, he be paid a salary of £1,100, to be increased to £1,200 by two annual increments of £50, also that the annual sum allowed to the Town Clerk out of the funds of the undertaking in respect of services rendered by him be increased to £200.

Mr. Reginald Ayton, city electrical engineer, Winchester Corporation, was married on October 29th, at Handsworth Parish Church, to Gwendolyn Anne, only daughter of Mr. and Mrs. W. A. Bloxham, of Handsworth Wood, Birmingham.

Mr. C. J. Spencer, who, as already stated, is relinquishing his post as general manager of the Bradford tramways for a position in London, was last week presented with an illuminated address, a clock and bronzes by the employés of the department.

General.—Lieutenant John A. Miller, R.E., of Glasgow, is now in the Department of the Chief Mechanical Engineer, War Office.

Mr. H. A. Norman White, late of Messrs. Marsh Bros., Ltd., electricians, Fargate, Sheffield, having taken up a position with Messrs. Coates & Co. (Sheffield), Ltd., has been presented with a cigar case by the employés of his late firm.

Ald. G. Weeks, of Messrs. Weeks & Son, electricians, Bromley (Kent) and Beckenham, has been presented with his portrait in oils by the townspeople of Bromley, in recognition of his long public services as Mayor, Deputy-Mayor, &c.

The *Financier* states that Mr. D. B. Morison, the well-known engineer, has been appointed chairman of Richardsons, Westgarth & Co., Ltd., in succession to the late Mr. W. J. Richardson and the late Lord Furness.

Mr. R. W. Dalton, H.M. Trade Commissioner for New Zealand, who is now in London, can be seen at the Department of Overseas Trade by appointment.

Messrs. Enterprise Manufacturing Co., Ltd., announce that Messrs. Henry Ashdown and Sidney Dicks resigned their positions as directors of the company on 21st ult., and ceased their connection with it. Mr. C. H. Roberts, as heretofore, will be responsible for the management. The scope of the company's activities will be considerably extended. Messrs. Ernest Joseph and William Harvey Utz have joined the board. Mr. Barrie will continue to represent the cohcern for the whole of the London districts.

Roll of Honour.—Second-Lieutenant Leslie John Poynter, 20th Manchesters, "C" Company, who was killed in action on October 25th in France, joined up as a private early in 1916. Up to that time he was chief assistant to his father, the managing director of Maxim Lamp Works, Canonbury Road, N.

The *Times* states that Lieutenant Charles Westcar Sheppard, R.E., who died of pneumonia following influenza on October 29th, aged 36, was educated at Charterhouse and Westminster, and afterwards at the Crystal Palace Engineering College. He was employed on the making of tube railways, the installation of electricity in Dublin, and large building operations near Plymouth; and was subsequently for a short period with the Board of Works. His knowledge of engineering becoming known, he was lent to the R.E. for roads and railways, and was placed in charge of a line. For his work with this he was recommended for a distinction. He transferred to the R.E., and for a time was at a home station, and was then lent, on application, to the Air Ministry, where he remained till within a week of his death.

Sergeant T. H. Little, R.A.F., who has been killed at a home station, served his articles as electrical engineer with Messrs. A. & P. Steven, of Glasgow.

Private H. S. French, Royal West Kent Regiment, formerly engaged at the Northampton electric light works, is reported killed after being missing for a year.

Sapper J. Farrer, R.E., who has been killed by a lion in East Africa whilst on duty with a wireless corps, was in civil life engaged in electrical work at Windermere.

Sergeant J. W. Fawcett, Border Regiment, who has fallen in action, was on the Kendal Corporation electricity works staff.

Second-Lieutenant W. Swift, Duke of Wellington's West Riding Regiment, killed in action, was on the electrical staff at Fryston Colliery (Yorks.).

Second-Lieutenant C. Plant, Sherwood Foresters, formerly a shift engineer and assistant at the Chesterfield municipal electricity works, has fallen in action.

Private C. Smith, who has died of sickness in France, was an electrician with Messrs. Siemens Bros., of Stafford.

Four members of the Doncaster Corporation tramways staff have been killed in action:—Second-Lieutenant J. A. Lamb, Private W. Atack, Private A. Greenham, and Private J. H. West.

Private W. McCoy, R.A.M.C., who has died in a London hospital from pneumonia, was employed by the British Westinghouse Co., Ltd., Trafford Park.

Private J. Powell, Royal Warwickshire Regiment, killed in action, was an employé of Messrs. Charles Macintosh and Co., Ltd., Manchester.

Lieutenant J. H. Waddington, R.A.F., killed on October 22nd, was an apprentice with the British Westinghouse Co., Ltd., Trafford Park.

Private W. Mounsey, King's Liverpool Regiment, killed in action, was employed as electrician at the Palace Theatre, Manchester.

The death in action is announced of Private A. J. Johnson, of the Birmingham Corporation electric supply department.

The death in hospital, in France, from pneumonia has taken place of Private R. Higham, L.N.L. Regiment, who was employed at the United Electric Car Works, Preston.

Second-Lieutenant R. N. Barr, West Riding Regiment, who has died of pneumonia, was in the accountants' department of the Leeds city tramways.

Private J. E. Smith, A.S.C., M.T., who has died from pneumonia, was employed at the Leeds Corporation electricity works.

Obituary.—Mr. Edward Bennis.—Last week we were only able to allude very briefly to the death of Mr. Edward Bennis, who passed away on October 28th. Mr. Bennis was born in Limerick in 1838. On leaving college he was apprenticed to Mr. Thomas Chandler, of Balls Mills, County Waterford, subsequently entering the service of Mr. Peter Moore Fisher, of Pilton, County Cork. He afterwards started in business on his own account. It was after having acquired a competency in industry, upon which he had retired, that he resolved to re-enter business, and took an active interest in the mechanical firing of boilers. Previous to the year 1873 the firing of boilers by mechanical means was almost unknown, though two types of machine-stokers were being used on a small scale. At this stage Mr. Bennis joined Mr. Dillwyn Smith, of Philadelphia. Works were started in Liverpool, but Mr. Bennis soon came to the conclusion that the system which provided only for throwing the fuel on the fire was incomplete, and that better results were possible if an efficient furnace could be devised by which the firebars would be automatically freed from clinkers whilst the machine distributed the fuel over the fire. He invented a self-cleaning furnace which answered the requirements he had set himself to meet, and these efforts were rewarded with success. He continued to improve his machine, and ultimately established works in Bolton. A new principle of machine-firing was later introduced, in which the coal was spread over the fire, not in a continual rain, as in the older machines, but by a striker which distributed it intermittently, striking the fuel a blow, and so varying the strength of this blow that only a part of the fire was covered at any one time, allowing a short period for the part of the fire on which coal was distributed to become incandescent. The newer principle effected a complete revolution in machine-firing. Others soon followed the lead given by Mr. Bennis, and in a very short time the subject of machine-firing had aroused such attention that a competition of mechanical stoker makers was held at the Manchester Sanitary Exhibition in 1882. A medal was issued for merit on the points of smoke abatement, power, and efficiency, and this was won by Mr. Bennis. Later, at the Yorkshire Jubilee Exhibition, a gold medal was offered for the best system of machine firing, and this again was won by Mr. Bennis. At these trials very onerous terms were imposed, the conditions requiring competitors to run the exhibition from morn till night without touching the fires, and with an absolutely smokeless chimney. More recently still, a newer system has been introduced by Mr. Bennis, in conjunction with his son, in which all the advantages of forced draught, machine firing, induced draught, and self-cleaning furnace have been concentrated in one invention. Further improvements and developments followed, and in 1904, the works at Bolton being found too small, a site for a new factory was obtained at Little Hulton. Since then the buildings and plant have been extended year after year to meet the continued growth of business. All types of machine stokers are now built, including chain grates for water-tube boilers, and every description of coal-handling device—coal bunkers, pneumatic ash-handling plant, conveyors for coal, cement, and like products. Of late years Mr. Bennis and his son have devoted much attention to the mechanical firing of boilers on board ship. Some early experiments in this direction met with considerable success, but improvements since made have shown that this branch of the subject is as fully open to exploitation as the automatic firing of ordinary boilers. Its development is, however, for the time being held in suspense in consequence of the war.

Mr. S. Turner.—Mr. Sam Turner, of Bury, who died last week from pneumonia following influenza, aged 43 years, was one of the directors of Messrs. Joseph Downham, Ltd., wholesale ironmongers, &c., Bury, and head of the electrical furnishing department of the firm.

Mr. H. E. Philpot.—The death occurred on October 27th, from pneumonia, of Mr. Hubert Edward Philpot, head of

the firm of Philpot & Co., electrical engineers, Canterbury and Ramsgate. Deceased, who was only 34 years of age, had for the past 10 years carried on the business established 50 years ago by his father, and since the age of 21 had controlled the electrical department.

Mr. C. Garnett.—At Darwen Corporation electricity works, on October 31st, a portrait was unveiled to the memory of the late electrical engineer, Mr. Charles Garnett. The inscription read:—

"Darwen Corporation.—As a token of esteem and respect to the late manager, from the Chairman, Vice-Chairman, and the Electricity and Destructor Staffs. October 31st, 1918."

NEW COMPANIES REGISTERED.

Manchester Aluminium Co., Ltd. (151,804).—Private company. Registered October 29th. Capital, £5,000 in £1 shares. To carry on the business of importers and exporters, and dealers in metal, metal scrap, ores, aluminium, brass, &c. The subscribers (each with one share) are:—J. D. Paton, Glenmuir, Leicester Road, Hale, Ches., consulting engineer; J. Ashworth, 47, Lonsdale Road, Bolton, engineer. The first directors are J. D. Paton and J. Ashworth. Registered office: 25, Market Street, Manchester.

Ferrotherm, Ltd. (151,801).—Private company. Registered October 29th. Capital, £3,000 in £1 shares. Engineers, contractors, electroplaters, electrochemists, iron founders, tube makers, &c. The subscribers (each with one share) are:—G. H. Alexander, Yeovilton Cottage, Everton, Hants, engineer; S. Wertheimer, 57-9, Long Acre, W.C. 2, engineer's agent. The directors are to be appointed by the subscribers. Registered office: 57-9, Long Acre, W.C. 2.

The Clyde Engineering Co., Ltd. (10,133).—Private company. Registered October 23rd. Capital, £10,000 in £1 shares. Mechanical, electric lighting, and general engineers, iron founders, shipbuilders and repairers, structural ironworkers, smiths, millwrights, iron, steel, brass, copper, and other metal manufacturers, oxy-acetylene and electric welders, and cutters of metals, &c. The subscribers (each with one share) are:—R. Wilson, 187, West George Street, Glasgow, solicitor; A. McDonald, 187, West George Street, Glasgow, law clerk. First directors are not named. Registered office: 187, West George Street, Glasgow.

CITY NOTES.

German Companies.

The Deutsche Gasgluhlicht A.G. (Auer Co.), of Berlin, which produces wire lamps as well as gas lighting appliances, reports net profits of £426,000 for 1917-18, as against £717,000 in the previous 12 months. The directors recommend the payment of a dividend of 25 per cent., being the same rate as in 1916-17.

The Deutsche Elektrizitats Werke Garbe, Lahmeyer & Co., of Aix-la-Chapelle, after setting aside £39,000 for depreciation in 1917-18, as against £37,000 in the previous year, report net profits of £78,000, as compared with £31,000 in 1916-17. It is proposed to distribute a dividend of 6 per cent., being the same rate as in 1916-17.

The Suddeutsches Telephon Apparat und Draktwerk A.G., of Nuremberg, whose share capital is held by the Felten and Guilleaume Co., records net profits of £50,000 for 1917-18, as contrasted with £27,000 in 1916-17, sums of £28,000 and £19,000 having previously been written off for depreciation.

The accounts of the *Kabelwerk Rheydt A.G., of Rheydt*, show net profits, without any provision being made for depreciation, amounting to £150,000 for 1917-18, as contrasted with £221,000 in 1916-17, when only £1,100 was written off. It is proposed to pay a dividend of 20 per cent., plus 20 per cent. bonus in War Loan, as compared with 20 per cent. in 1916-17, on a share capital of £350,000.

The report of the *Bayerische Stickstoff Werke A.G., of Munich*, states that the production of the company's own works at Trostberg and Tacherting, Bavaria, was materially less in 1917-18 than in the preceding year, owing to the inadequate allotment and supply of raw materials. The output of the Central German State Works, managed by the company, was satisfactory, but that of the Upper Silesian State Works was inconsiderable in consequence of the insufficient supply of power. War conditions hampered the extension of the Bavarian works; the new cyanamide plant was finished, but great delay took place in the completion of the power station and the carbide works. On the other hand, the enlargement of the State works was brought to a successful issue. After allocating £27,000 to depreciation, as compared with £34,000 in 1916-17, the accounts show net profits of £59,000, as against £77,000. It is intended to pay a dividend of 11 per cent., this contrasting with 14 per cent. in 1916-17.

New Issue.—*Callender's Cable & Construction Co., Ltd.*—The list opened on Monday and was to close on Wednesday to an issue of 40,000 6½ per cent. cumulative preference shares of £5 each at par, and 10,000 ordinary shares of £5 each at £7 per share, to provide further working capital.

West African Telegraph Co., Ltd.—Interim dividend at the rate of 4 per cent. per annum for the half-year to June 30th.

Siemens Bros. & Co., Ltd.—Interim dividend at the rate of 10 per cent. per annum, free of tax.

Dick, Kerr & Co., Ltd.—The profits earned during the 12 months' trading to June, 1918, were £87,916, plus £36,074 brought forward, making £123,989. Out of this debenture interest and trustees' fees have been paid, and there has been reserved the sum required to provide for the premium payable on the redemption of the present debenture stock. These items absorb £10,129; 6 per cent. dividend on the preference shares absorbs £21,000; 10 per cent. is to be paid on the ordinary shares, requiring £30,000; £25,000 is put to supplement the special reserve for contingencies, and £37,860 is to be carried forward. Although the amount of excess profits levy under the Munitions of War Act has not been finally settled, the directors believe that the reserves which they have made in the accounts for extra depreciation, special taxation, &c., are sufficient, and they therefore feel justified in recommending the above dividend on the ordinary shares. All the works have been occupied during the year, although in the case of the United Electric Car Co. a considerable portion of the time has been occupied in extensions and alterations necessary to produce important work of a nature specially suited to that establishment. Messrs. B. A. Firth and G. Mure Ritchie have been appointed directors.

Drake & Gorham, Ltd.—For the year ended June 30th, 1918, after payment of all charges, including bonuses to staff, war allowances, and provision for contingencies, the net profit is £18,781, plus £2,296 brought forward. A dividend of 7½ per cent. absorbs £9,375, £5,000 is put to writing down goodwill, and £6,702 is carried forward, subject to deduction for excess profits duty, if any. The turnover constitutes a record in the history of the firm, contracts consisting mainly of national work. The business of the wholesale trade department shows an increase of about 30 per cent. on last year's figures, and covers the supply of electrical goods of all kinds to municipalities, tramway companies, and contractors. Manufacturing has for some months been in full operation at the new premises, Rockingham Works, Newington Causeway.

West India & Panama Telegraph Co., Ltd.—Interim dividends for the six months to June 30th: 6s. per share on the first preference shares, 6s. per share on the second preference shares, and 6d. per share on the ordinary shares (free of income-tax).

City of Buenos Aires Tramways Co., Ltd.—Dividend of 1s. 3d. per share (at the rate of 5 per cent. per annum), less income-tax, for the three months ended September 30th.

Calcutta Electric Supply Corporation, Ltd.—Units sold during five weeks ended August 30th 3,464,148, compared with 2,982,020 in 1917.

Anglo-Portuguese Telephone Co., Ltd.—Interim dividend of 3 per cent., less income-tax, on account of the year ending December 31st, 1918.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets have shown greater buoyancy this week than they have done since the outbreak of the war. Animation and cheerfulness have ruled in most departments, and where prices have not moved quotably, this is more frequently due to lack of stock than want of support. The end of the war is in sight, and the only question is how soon it will be before Germany breaks up in one way or another; such, at any rate, appears to be the view reflected in the markets of the Stock Exchange.

Why Home Rails should be racing up in price is not quite clear even to those most intimately concerned. The position is not intrinsically different from what it was weeks ago. But buyers have come along in force, prices have mounted merrily, and in this week's list Metropolitan Consolidated is a very strong feature. Underground Incomes have gone up to 89. Central London guaranteed assented stocks are all better. Notable strength is shown by the Scottish stocks of various kinds.

Electric Lighting shares are quietly good. County ordinary reacted 5s. to 11 after their recent big rise, but Charing Cross preference gained ½. Urban preference are better at 24. There has been little slackening in the demand for shares, but the narrowness of the market, and the difficulty of buying shares, is a factor that makes perforce for quietude. If investors find they cannot buy in one market, they naturally turn to another department where greater elasticity prevails.

Securities in such companies as those which have suffered from fuel shortage are enjoying a little pre-peace consolation. Anglo-Argentine Tramways make a case in point. The first preference shares fell at one time at 24, whereas now they are difficult to buy at 4. The second preference have sympathetically improved. British Columbia electric issues have come up by many points in the past two or three weeks. Electric railways and tramways in various far parts of the world are being inquired for, and holders do not wish to sell. Mexicans continue good, but the only noticeable alteration this week is a rise of 1 in Mexico Tramways first bonds. Brazilian Tractions have recovered the 1½ points shed last week.

Callender's new issue has aroused considerable interest. The company followed the example recently set by the General Electric Co. in offering preference and ordinary shares together, with the statement that in the allotment of ordinary shares preference will be given to applications for both ordinary and preference shares in the proportion of one ordinary for every four preference. The latter are offered at £5, and the ordinary at £7, that is, at par, and a premium of £2 respectively. The market prices of the existing issue stand at 5¼ and 9¾. The company is paying an underwriting commission of 2½ per cent., and an over-riding commission of ¼ per cent. on the whole issue, preference and ordinary. As the subscription lists closed a day in advance of the full term it will be obvious that the company has achieved success with its offer.

Marconis come on offer fairly freely as the price approaches £5, but the shares keep steady round about 4¾, with Americans 32s. 6d., Marconi Marines 3½, and Canadians 14s. 9d. There is not much change in cable descriptions. The Eastern group keeps very hard. West India and Panama gave way to a slight extent.

British Westinghouse ordinary are in demand at 40s., and the preference have risen 1/16 to 2 9/16. Crompton preference are a good market at 20s., at which price they can be obtained. The ordinary are 16s. 6d. Chelsea 6 per cent. preference are wanted about 91s., and South London 6 per cent. preference at 4¾. Victoria Falls ordinary have stiffened to 20s. 6d., the preference remaining about 25s. 6d. Castner Kellners drooped to 3¾. British Aluminiums are the turn easier. Rubber shares remain a fairly hard market, interest centring for the moment in those Middle East companies that produce coffee as well as rubber.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Nov. 5, 1918.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6⅝	—	£7 17 0
Charing Cross Ordinary	5	4	3¼	—	5 18 6
do. do. do. 4½ Pref.	4½	4½	3⅞	+ ⅛	6 13 4
Chelsea	3	5	3⅛	—	7 16 10
City of London	8	8	13½	—	6 0 6
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
County of London	7	7	11	— ½	6 7 3
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	6	7	8¼	—	6 17 7
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	3¾	—	7 2 10
Metropolitan	3	4	3½	—	6 10 7
do. 4½ per cent. Pref.	4½	4½	3⅝	—	6 18 6
St. James' and Pall Mall	8	9	6⅞	—	6 13 4
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	20/8	—	6 16 7
Westminster Ordinary	7	9	6¾	—	6 13 6
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	99xd	—	6 1 0
do. Def.	1½	1½	23⅜	—	6 8 6
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	16	—	*5 0 0
Eastern Tel. Ord.	8	8	16½	—	*4 19 1
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 5
do. do. Pref.	6	6	10½	—	5 14 3
Great Northern Tel.	24	22	34	—	6 9 5
Indo-European	13	13	57½xd	—	5 13 0
Marconi	15	20	4¾	— ¼	4 2 0
Oriental Telephone Ord.	10	10	3½	—	2 17 2
United R. Plate Tel.	8	8	7½xd	—	*5 5 0
West India and Panama	6d.	1/3	1⅛	— 1/16	*3 13 6
Western Telegraph	8	8	17	—	*4 14 2
Home Rails.					
Central London Ord. Assented	4	4	6¾	+2	6 2 2
Metropolitan	—	1	29½	+2½	3 17 3
do. District	Nil	Nil	26½	+ ½	Nil
Underground Electric Ordinary	Nil	Nil	8	+ ¼	Nil
do. do. "A"	Nil	Nil	8/-	+6d.	Nil
do. do. Income	6	4	80	+1½	*4 10 0
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3⅞	+ ⅛	—
do. do. 2nd Pref.	5½	—	3⅜	—	—
do. do. 5 Deb.	5	5	76	+1	6 11 7
Brazil Tractions	—	—	58	+1½	—
Bombay Electric Pref.	6	6	102	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	64	+1	7 16 8
do. do. Preferred	Nil	Nil	45½	—	Nil
do. do. Deferred	Nil	Nil	44½	—	Nil
do. do. Deb.	4½	4½	61½	—	6 18 3
Mexico Trams 5 per cent. Bonds	Nil	Nil	65	+1	Nil
do. 6 per cent. Bonds	Nil	Nil	80	—	Nil
Mexican Light Common	Nil	Nil	37½	—	Nil
do. Pref.	Nil	Nil	50	—	Nil
do. 1st Bonds	Nil	Nil	71	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3⅝xd	—	4 1 4
British Aluminium Ord.	10	10	1⅝	—7½d.	5 12 4
British Insulated Ord.	20	20	2¾	—	4 9 0
British Westinghouse Pref.	7½	7½	2⅜	+ 1/16	5 17 0
Callenders	20	25	9¾xd	—	6 8 0
do. 5 Pref.	5	5	5¼	—	—
Castner-Kellner	22	20	3¾	— 1/16	5 10 4
Edison-Swan, "A"	—	—	4	—	Nil
do. do. 4 per cent. Deb.	4	4	73¼	—	5 6 0
Electric Construction	7½	10	1¼	—	7 5 6
Gen. Elec. Pref.	6	6	10¾	—	6 2 4
do. Ord.	10	10	18	—	*5 11 1
Henley	25	25	3¼	—	6 11 2
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17½	—	*5 14 8
Telegraph Con.	20	20	49	—	*4 18 0

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, November 6th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£100	..
a Ammonia, Muriate (large crystal)	"	£77	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£13	..
a Copper Sulphate	"	£93	£3 dec.
a Potash, Chlorate	per lb.	3¼	..
a " Perchlorate	"	3/-	..
a Shellac	per cwt.	£17 10/-	..
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	"	£34	..
a " Lump	"	£26	..
a Soda, Chlorate	per lb.	1/1	..
a " Crystals	per ton	£7	..
a Sodium Bichromate, casks	per lb.	17½/-	..
METALS, &c.			
c Brass (rolled metal 2' to 12' basis)	per lb.	..	..
c " Tubes (solid drawn)	"	..	..
c " Wire, basis	"	..	..
c Copper Tubes (solid drawn)	"	1/8½ to 1/9	..
g " Bars (best selected)	per ton	£161	..
g " Sheet	"	£161	..
g " Rod	"	£161	..
g " (Electrolytic) Bars	"	£137	..
d " " Sheets	"	£161	..
d " " Wire Rods	"	£145	..
d " " H.C. Wire	per lb.	1/5½	..
f Ebonite Rod	"	8/-	..
f " Sheet	"	2/6	..
a German Silver Wire	"	2/6	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	2/8½	5½d. dec.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£37	..
g Lead, English Pig	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	9d. to 4/6	3d. to 1/6 inc.
e " " " medium	"	5/- to 10/-	1/6 to 4/- inc.
e " " " large	"	12/6 to 25/- & up.	5/- to 11/- & up inc.
d Silicium Bronze Wire	per lb.	1/10	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	..	..
n " Wire, Nos. 1 to 16	per lb.	5/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Smooth versus Undercut Commutators.—Because in many cases continuity of service in an electrolytic plant is one of the most important factors entering into the plant's success, the matter of having an adequate supply of electrical energy at all times is absolutely vital. This factor led a chemical company in the Middle West to study closely the varying conditions with both smooth and undercut commutators on its generators. It was found that although 100 per cent. service continuity and load factor could be obtained when smooth commutators were used on generators and motors, no like results could be obtained with the undercut commutators. This record was made possible by the use of an ordinary grade of domestic-made brush and by taking daily care of the commutator (says the *Electrical World*). Each morning two men sandpaper the commutators with the paper attached to a concave-shaped wood block. One man applies the block, the other holds a bunch of dry waste against the commutator directly behind the block to catch the copper dust. Each machine is thus treated for about 30 minutes. Then, without detaching any shunt wires, each brush is slipped from its holder and cleaned with sandpaper just enough to remove the particles of copper that may lodge on the wearing surface. The brush is then replaced, and the machine will operate satisfactorily for another 24 hours. In 20 years the commutators have not lost more than 1½ in. (3·8 cm.) total diameter, and they seem to be good for many years more. In fact, a half-hour's sanding barely removes the dirt, and does not even remove entirely the brown gloss from the surface. The undercutting, however, shortened continuous operating periods down to six weeks, and the machine would show distress at slight overloads. Different makes of brush and different modes of manipulation were tried, but the trouble could not be eliminated without smoothing down the commutator. The reason that the undercut commutator is not very good is thought to be that the slot gets foul with carbon and copper dust, and the tendency is to drag copper across the segments, making ideal short-circuit conditions. When an undercut commutator starts to give trouble, there is no recourse but to shut down the machine, while, on the other hand, smooth commutators under like conditions can always be brought back to good behaviour by using sandpaper without reducing the load. It is not mechanically correct to dig grooves across the wearing surface at right angles to the line of motion; it is thought that with a properly-built and operated commutator, high mica is non-existent. Soft mica, which is usually amber-coloured, is the proper kind to use, and even the hard white mica will do if first split into thin sheets about the thickness of writing paper.

THE FUNCTIONS OF THE GOVERNMENT IN RELATION TO INDUSTRY.*

By W. L. HICHENS.

The habitual tendency of Englishmen is to drift down the stream of life without inquiring where they are going, and without any very definite ideas as to where they want to go. "We muddle through somehow," we say to each other with a smile of easy-going satisfaction, thinking the while that it is others—usually the Government—who have made the muddle, and that it is we—the men in the street—who have saved the situation.

We blame the Government because the war took us by surprise and found us wholly unprepared, and we flatter ourselves (not without reason) because we have made a glorious recovery.

And just as we were unprepared for war in 1914, so now, in 1918, we are unprepared for peace. We muddled into war, and we shall muddle into peace. Not until we find ourselves wallowing in a Serbonian bog of confusion shall we bestir ourselves, and then we shall damn the politician, and make the best of a bad job. The politician is, of course, no more to blame than we are ourselves. He doesn't lead because we refuse to be led; he pursues a policy of masterly inactivity because we decline to budge. But there are times when we must look ahead, and make up our minds what goal we mean to reach. We have arrived at a veritable network of crossroads to-day. Shall we not, then, cry a halt, and choose our way with deliberation? Or are we in such a hurry that we dare not pause?

I would like to pause to-day and inquire whither the Government proposes to lead the industries of this country, before I step into the train of post-war industrial reform. I have no desire to find myself in a non-stop train hurrying headlong to the destination of State Socialism. My fear is that we shall be "all aboard," the whistle will blow, and we shall be off before we realise whither we are bound and where we want to go.

We have become so accustomed to Government control in the everyday affairs of life during the war, we are so inured to the establishment of new departments and new Controllers, that the invasion of what were formerly regarded as the rights of the individual no longer shocks or alarms us. The list of functions which it is proposed in different quarters that the Government shall undertake in the industrial and commercial spheres has assumed truly staggering proportions. Proposals have been made to nationalise the railways, all road and water transport services, the coal mines, private armament firms, and shipbuilding firms; it has been proposed that the State shall establish super-power stations for the supply of cheap electric power; that it shall embark on an extensive housing scheme; that it shall finance or take over the key industries; that it shall convert the national factories into industrial concerns and run them for profit; that it shall nationalise the liquor trade; that it shall develop for profit selected resources of the Empire; that it shall be the sole purveyor of the prime necessities of life.

Here is a formidable list of industrial activities for the State to assume as a part of its reconstruction programme, and before committing ourselves as a nation to so ambitious a policy, it would be well to consider it carefully from all sides, since, once we have embarked upon it, it will be hard to retrace our steps. I will give some of the reasons why I think the Government should keep outside the arena of commerce and industry.

In the first place, the Government has already more than enough to do without annexing a vast new sphere of activity. Even before the war the business of Parliament was hopelessly congested, and no one will contend that in the turmoil and confusion of the next few years its duties will be lightened. If the Government and Parliament have failed lamentably to handle the business entrusted to them with any approach to efficiency, what chance is there that they will prove equal to the task of running complicated and exacting industrial undertakings? It would be the height of folly to allow the Government to embark on these new ventures while their own house is in a state of grave disorder.

The second objection to State trading is that it tends to create international complications, and increases the risk of war. Most people will agree that the international problems of the next generation will be in a great measure economic, for the war has brought out the fact that military strength is largely dependent upon economic and industrial resources. The importance, therefore, to a country of commerce and industry is likely to be more fully realised than ever before, and its promotion will be a primary object with all Governments. Each Government should therefore be in a position to consider these international problems from as broad and detached a point of view as possible, and should not be directly implicated as itself a trader. A rate war, for example, in the trans-Atlantic trade would be a far more serious matter if it were carried on by the Governments of the countries concerned than if it were instigated by private firms. Trade questions and diplomatic questions would thus become largely synonomous, to the risk of the peace of the world. Before the war the German Government was already tending to assume the functions of a bagman, and to exercise them in a manner which was both undignified and dangerous. Economic problems will probably bulk large at the peace conference, and it is to be hoped that an attempt will be made to define the limits within which State intervention in matters of foreign trade is justified.

A third objection to State trading on an extensive scale is that it creates a large army of Civil Service voters, who, in exercising the franchise, may find it difficult to forget that their material prospects can be better promoted by one candidate than another.

A fourth objection to State trading is that the organisation of a Government department must necessarily differ from that of a private business. You cannot run a public office on business lines, because the conditions of the public service and private undertakings differ *toto cælo*, and demand a different form of organisation. In business it is necessary to act promptly, to take risks, to have a free hand, to talk as little as possible. Now, a Government is handicapped in all these respects because of its responsibility to Parliament and the public. If Treasury control is relaxed, and subsequently some blunder is brought to light by the Public Accounts Committee, we are treated to a homily on the importance of a close financial supervision. It is natural to all of us that we should wish to err on the side of safety, and in the case of the Treasury over-control is safer than under-control. Hence arise many vexations, interferences, and heart-burnings. At a certain national factory it was decided to start a social club for the workers. The managers were keen, the workers took up the idea warmly, an atmosphere of enthusiasm was created. Obviously it was necessary to strike while the iron was hot; moreover an option, which had been obtained on the only suitable building, had to be exercised at once, or it lapsed in favour of another party. But the scheme involved an initial outlay of a few hundred pounds for which Treasury sanction was necessary, and the wheels of the gods grind slowly, as it is over eight months ago since all the details were worked out—but no Treasury sanction has yet been received. Therefore, officially the scheme is in a state of suspended animation, and is likely to remain so, since the game of battledore and shuttlecock is still in full swing. Unofficially—but that is another story. I do not wish to criticise the delay; it is inevitable, it is inherent in the Parliamentary system. The fact is that "State management on sound commercial lines," "A business Government," are parrot cries incapable of realisation so long as Parliamentary control remains a reality and so long as the party system continues.

I do not wish to suggest that Civil Service administration is less efficient than business management. Mistakes are made in both. The organisation of public and private services is necessarily different because they are primarily designed for different purposes; and the delays, circumlocution, and red tape which one associates with the Government service are in a great measure inevitable. The moral I would draw is that these methods are unsuitable to industry, and fore-doom it to failure.

A fifth objection to State trading is that it eliminates competition, and introduces a rigid uniformity of administration which results in stagnation. A healthy competition is the lifeblood of industry, and diversity of method is the best guarantee of progress. If Treasury sanction has to be sought before new methods can be adopted and experiments can be carried out, if the responsibility and initiative of the individual are curtailed, if all changes are hedged round with formalities, a shrewd blow will be struck at progress. And it is right that after the war the Treasury should watch all public expenditure with a jealous eye. It will be obliged to balance the rival claims of education, railways, super-power stations, housing, and a host of other things if State trading is to be the order of the day, with the result that they will all be starved. The State, again, will not dare to take the risks that private enterprise does, and must if it is to be successful. What is likely to happen if a Government not too securely seated on its Parliamentary throne is invited to undertake a transaction in its business capacity which may lead to brilliant results, or end in dismal failure? It will think of its shaky majority, it will reflect on the hostile criticisms of the Opposition and the Press, and in nine cases out of ten will play for safety. It is always easier to defend the *status quo* than to explain away a failure. The man of business knows this as well as the politician, but under stress of competition he is obliged to adopt the policy of "nothing venture nothing have," and on the whole he has ventured wisely. England's commercial greatness has been built up by the initiative and sturdy independence of the business community coupled with the skill of its craftsmen, and it is to the same characteristics that we must look for the maintenance and development of her trade.

There is one final objection to State trading. By itself entering the arena of trade the State loses the detachment and impartiality which are expected from the ultimate controlling authority. It becomes an interested party, and its decisions are at once suspect. For if the State is a large employer of labour, how can it determine the industrial disputes in which it is itself interested?

I have dealt with the question of State trading at some

* Abstract of a lecture delivered at the Industrial Reconstruction Council, London, October 30th, 1918.

length because there are strong forces at work which appear to me to be driving us in that direction, and unless we take a firm stand now I fear that we may find ourselves driven violently down a steep place into the sea.

Having eliminated trading as one of the functions of the Government in relation to industry, I will abandon the negative method and attempt a constructive definition. I would suggest that the primary function of the Government in relation to industry is to determine the conditions under which industry shall be conducted by private individuals, firms, or corporations, and to see that those conditions are carried out. The first duty of the Government and Parliament is to secure justice as between one section of the community and another. They have to see that a boot-maker, for example, makes his boots under conditions that are fair to his workmen and to the rest of the community—not to make boots themselves.

The first duty of a Government is to secure justice to *all*, not merely to a majority, and in relation to industry its primary function is to determine the conditions under which industries shall be conducted, and to see that those conditions are carried out. Hitherto it has conspicuously failed in both respects. It has rarely had a consistent policy, and it has still more rarely seen its policy through.

To secure the confidence of both employers and employed it should be recognised as being disinterested, and if it is itself to be the largest employer of labour it will disqualify itself as the final court of appeal. To-day there are two fundamental problems which are exercising the minds of the workers—profiteering and the status of Labour. They claim—and rightly claim—that Capital shall not be unduly rewarded in relation to themselves, and that their voice shall have due weight in determining the conditions under which industry shall be carried on. The employer likewise has two bugbears—restriction of output and strikes. He sees that the material prosperity of the country depends upon the production of wealth, and that there can be no real improvement in the former except by increasing the latter. He knows that fundamentally the interests of Capital and Labour are the same; that both are necessary to the production of wealth; that both employers and employed are members of one corporate body, with distinct functions, but one common goal. Unfortunately, the common goal is obscured by the mists of controversy, the vessel is allowed to drift towards the rocks, while the members of the ship's company dispute over their respective duties and rewards.

It is obviously important that employers and employed should, in the first instance, hammer out their differences amongst themselves. But if they fail to agree, or if their agreement is against the public interest, the final decision, which should be binding on both sides, must rest with the Government elected by the whole community. There must be some outside and impartial authority to resolve the difference of the two parties, or the result will be anarchy. This—which is by far the most important function of the State in relation to industry—has never been fully recognised.

It is the Government's business to stop profiteering and to stop exorbitant wages; it is for the Government to determine in the last resort the hours and the general conditions of labour; it is for the Government to hold the scales of justice evenly between Labour and Capital when differences arise.

Assuredly it is no light task that Parliament and the Government are thus called upon to undertake in relation to industry. It involves an intimate knowledge of industrial conditions which they have never yet attained, and a degree of control which would make the bones of the members of the old *laissez faire* school turn in their graves. But it differs even more widely from the task which the State Socialists would impose on the Government. For they would endow the Government with the functions of umpire and batsman in the same game, whereas, in the view put forward, it is essential that the two should be kept separate.

The secondary functions of the Government in relation to industry are of very real importance, and they often bulk more largely in the public eye than the one which I have stressed to-day. They may be grouped, broadly, under the heading of the encouragement of industrial development. In this category come the promotion of industrial research, the development of the consular services, the thorny problem of the support of the key industries, the still more controversial problem of protection *versus* free trade. In this category may also be included the elimination or prevention of wasteful competition. For, if competition has its uses it has also its abuses. The competition among the British railway companies before the war is a case in point. No one would wish, I believe, to revert to the old conditions, or fail to recognise the great advantages and economies arising from a closer co-ordination. It is for the State to step in and insist that this co-ordination is carried out on right lines. Similarly, it has been brought home to the country that a broad and comprehensive scheme for the supply of cheap electric power through big central stations is of vital importance to industrial development. But the task of reducing the present chaos to order is beyond the powers of private enterprise without legislative assistance. It is urgently necessary that the Government should lay down the conditions under which these super-power stations may be erected, but, having done this, they should leave the actual work to be carried out by private enterprise.

These, briefly, are some of the problems which the Government is called upon to face in the interests of industrial development, and their mere enumeration conveys a striking picture of the magnitude of the task with which the Government is faced. I have made no reference at all, it may be noticed, to the question of Government control during the transitional period following upon the conclusion of peace. The reason is that I am not concerned with a temporary and wholly exceptional phase in our industrial life which we shall all wish to abridge as much as possible.

I have thought it best to concentrate upon the primary function of the Government in relation to industry, which is, I repeat, to determine the conditions under which industry shall be conducted by private enterprise, and to see that those conditions are carried out. And I have emphasised this aspect because there is a real danger, in my view, that the Government will try to turn trader and attempt to remedy its sins of omission by sins of commission, which will merely make confusion worse confounded.

RECOVERY OF CHARGES IN THE COUNTY COURT.

[FROM OUR LEGAL CONTRIBUTOR.]

A CORRESPONDENT of the ELECTRICAL REVIEW has recently propounded two questions of apparent simplicity, namely, (1) Can an electric supply company sucessfully sue in the County Court any consumer to whom the company has sent a quarterly bill for the amount of the minimum charge of 11s. 8d. for any energy he may have consumed in the quarter? and (2) Whether, in addition to such charge of 11s. 8d. per quarter, it would be legal to charge meter rent? He suggests that under the maximum prices schedule in the company's provisional order the company has the right to make charges, and draws attention to the following clause: "Where the undertakers charge any consumer by the actual amount of energy supplied to him they shall be entitled to charge him at the following rates per quarter. For any amount up to twenty units eleven shillings and eightpence, and for each unit over twenty units, sevenpence." He adds that in two County Court cases of recent date claims of this kind were decided against a supply company.

Assuming that each consumer became an assenting party to these charges when he entered into a contract for a supply, it is difficult to see how the claim of the undertakers could be resisted. There is usually a clause in every consumer's contract by which the relevant clauses of the provisional order are incorporated, and the consumer who signs the document automatically becomes bound by it. As to meter rent, that, too, is generally the subject matter of agreement; and there seems to be no reason why the meter rent should not be recovered in accordance with the terms of the contract by an action in the County Court.

It is important to note that the maximum charge above referred to does not depend upon any meter reading. It is a definite amount to which the company is to be entitled in any event. As regards the amount in addition, this depends upon the meter reading, which, generally speaking, is final and binding upon both supplier and supplied.

Possibly the County Court decisions referred to are based upon a misconception of a recent decision in the High Court to which it may be well to take this opportunity of referring. In Hendon Electric Supply Co., Ltd., *v.* Banks (87 Law Journal, p. 790), which is now reported in all the law reports, a supply company did fail to recover its charges in the County Court in circumstances which were somewhat peculiar. A consumer had agreed to the supply being ascertained by a meter provided by the company. The contract, however, incorporated the terms of 8 Cl. 57 of the schedule to the Electric Lighting (Clauses) Act, which provides as follows: "If any difference arises between any consumer and the undertakers as to whether any meter, whereby the value of the supply is ascertained (whether belonging to the consumer or to the undertakers), is or is not in proper order for correctly registering that value, or as to whether the value has been correctly registered in any case by any meter, that difference shall be determined upon the application of either party by an electric inspector or, where the local authority are the consumers, by an inspector to be appointed by the Board of Trade, and that inspector shall also order by which of the parties the costs of and incidental to the proceedings before him shall be paid, and the decision of the inspector shall be final and binding on all parties. Subject, as aforesaid, the register of the meter shall be conclusive evidence in the absence of fraud of the value of the supply."

In February, 1917, it was found that a meter fixed on the consumer's premises had recorded nothing, and it was replaced by another instrument. In point of fact, the locking pin had never been released. The plaintiff company then sought to recover in the County Court on an estimate of the energy consumed during the period when the meter was not running, the estimate being based upon the amount registered during the corresponding quarter of the previous year. The Court held that the company could not recover. Mr. Justice Lawrence, in the course of his judgment, said: "Now clause 57 of the schedule to the Electric Lighting (Clauses) Act,

1899, provides that where a difference arises between the customer and the undertakers, as to whether any meter is in proper order for registering the value of the supply, that difference shall be determined upon the application of either party, by an electric inspector appointed by the local authority or by the Board of Trade, and that inspector shall decide by which of the parties the costs of the proceedings before him shall be paid, and the decision of the inspector shall be final and binding on all parties.

"In the present case the defendant demanded the determination of the dispute in this manner, but unfortunately no electric inspector had at that time been appointed. The County Court judge was not entitled to determine the dispute, and to assess the amount of electricity consumed. Where an Act of Parliament has, as it has here, provided a mode of determining such a dispute, no cause of action arises until the dispute is determined in the manner provided. In my opinion, the appeal must be dismissed."

There can be no doubt as to the correctness of this decision. The proper course for the company to pursue was to secure the appointment of an electric inspector, as soon as it was found that the meter was not working. He was the person to say (*a*) whether the meter was in order for correctly registering the value, and (*b*) whether the value had been correctly registered. If he arrived at the conclusion that the meter was defective he could then (it is submitted) have determined the value of the energy used. When he had made his valuation, if the consumer still refused to pay, he might have been sued for the amount in the County Court.

It came out in the course of the case that in fact there was no electric inspector in the Hendon district; but that did not affect the question. The determination of the accuracy of meters is left to electric inspectors and not to County Court judges.

As to the general question whether an electric lighting company can sue for its lawful charges, the answer is clearly in the affirmative. If there is no question as to the accuracy of the meter, there can be no defence to the action. Charges may be recovered summarily as civil debts in a court of summary jurisdiction (see S. 40 of the Gasworks Clauses Act, 1871, incorporated with the Electric Lighting Acts) or in the County Court. (*Ib.* S. 41). The fact that such cases are rare may be partly due to the fact that undertakers are able to exercise an undoubted right to cut off the supply to anyone who refuses to pay what is due.

ELECTRIC ARC WELDING.*

By A. M. CANDY.

(*Concluded from page* 415.)

In foundries and machine shops, many applications for arc welding equipments may be found, the principal one of which is probably that of cutting risers off castings. The cross sectional area of such risers is frequently quite large, but by using a current of 600 to 800 amperes they can be removed readily. Occasionally, during the operation of machining a casting, blow-holes will be revealed which may seriously impair the strength and appearance of the casting. Without removing the piece from the machine such defects can be readily repaired by arc welding, as is illustrated by fig. 1. In this instance, a large blow-hole was discovered in

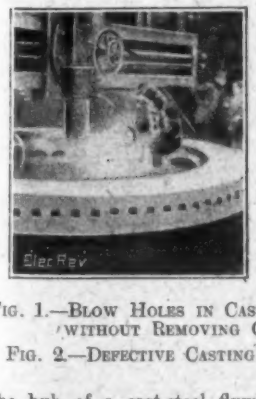

Fig. 1.—Blow Holes in Casting repaired by Arc Welding without Removing Casting from Machine.

Fig. 2.—Defective Casting Reclaimed by Arc Welding.

the hub of a cast-steel flywheel. The defect was satisfactorily repaired in 15 minutes. Fig. 2 illustrates a most interesting instance of reclaiming a defective casting through the medium of arc welding. Due to an oversight in a foundry, six cast steel frames for large mill motors were cast without the supporting members for the axle brackets. The loss involved was quite an item, and therefore it was decided to endeavour to repair the castings by the arc welding process. Supporting pieces of steel were prepared, the ends being welded to the frame and axle brackets as indicated. A very successful job resulted, which has been entirely satisfactory.

Tramway systems have many applications for arc welding, such as repairing broken motor frames, brake rigging, worn rails, and in fact all steel parts subject to wear. Fig. 3 indicates a very common example, namely, that of armature shafts which have been worn excessively. It is practicable to build new material on these shafts by the arc welding process, after which the shafts may be machined to size in the usual manner. This process is considerably less expensive than pressing out the old shaft, which must be scrapped, and pressing in a new shaft. If the armature punchings are built directly on the shaft, then the saving is very marked, because in many such instances the removal of the shaft means practically rebuilding the armature. Another interesting application is that of building material on worn track

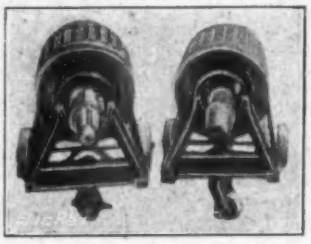

Fig. 3.

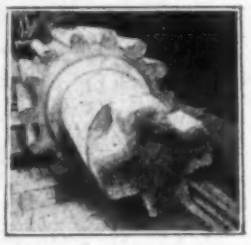

Fig. 4.

Fig. 3.—Worn Armature Shafts Built up by Arc Welding.
Fig. 4.—Large Pinion Reclaimed after Wear.

frogs and crossings which are subject to severe and rapid local wear at the points, which are hammered by the wheels of passing cars. It is frequently difficult and expensive to replace such pieces of special track work in busy streets of large cities, and therefore the arc welding process is very commendable, as the worn parts can be built up and ground to shape without being removed. There are also authorities who recommend welding the fish plates or rail joints to the rails instead of the bolted or riveted construction used heretofore.

In steel mills electric arc welding can be used to advantage in many applications. For example, fig. 5 illustrates two steel mill wobblers, the ends of which have been repaired by the arc welding process; the white lines indicate the new metal deposited. It is interesting to observe that these wobblers are worth approximately $1,000 apiece, whereas the cost of repairing by the arc welding process is but $85 each.

Fig. 5.—Worn Steel-mill Wobblers Repaired by Arc Welding.

These wobblers could not be saved in any other manner. Fig. 4 shows a large pinion which was reclaimed in a similar manner.

Blast furnaces, which are an adjunct to steel mills, present a very interesting application, namely, that of burning out the furnace tap holes. By using the carbon arc it is possible to burn the cold metal plugging the tap hole so that the molten metal will flow. If the hole becomes clogged with cinder or other non-conductor, it is only necessary to drive a steel bar into the hole until it makes contact with the molten metal, after which the steel bar may be melted by the carbon arc, thus releasing the molten metal. For this service special appliances are necessary. First, a carbon rod several inches in diameter and about 4 ft. long must be inserted in a suitable piece of wrought iron pipe to which a long wooden handle is secured. Second, arrangements must be made for supporting this electrode, so that the operator need not work in a position too close to the furnace for safety.

Probably the most extensive field for arc welding, however, is that of steam railway repair shops. All steam locomotives are subject to rapid deterioration, many parts requiring frequent repair or replacement. With the arc welding process such breaks may be repaired without dismantling.

The welding of flues in locomotive boilers is probably the most profitable application in steam railway shops. Prior to the introduction of the arc welding process the flues were inserted in the rear fire sheet, and the end of the tube allowed to extend beyond the sheet a sufficient distance so that it could be flanged or turned; the tube was also expanded slightly just inside of the sheet. Flues mounted in this manner will hold without severe leaking for quite a time.

* *Journal*, A.I.E.E., Vol. 38, No. 9. Abstract.

but will gradually become sufficiently loose to necessitate repairs. Experience has demonstrated that the tubes can be welded to the flue sheet by the electric arc process. A number of the large railroads have adopted this process and are obtaining very satisfactory results.

ELECTRICAL DEVELOPMENTS FOR THE AMERICAN ARMY.

Illustrated articles in the *Electrical World* and *Power*, by Mr. Robert T. Tomlin, Staff Correspondent in France, give some idea of the electrical developments for the American Army in France. It should be understood that there is nothing of finality in what is said. Conditions change rapidly. Coupled with the conditions of uncertainty, the chief difficulty that has to be overcome is the scarcity of electrical material and equipment available for quick delivery. It should be remembered that the Americans are working in a country that has seen four years of war. Electrical equipment that was of use to the Allies early in the campaign has long since been rounded up and placed in service. The electric power demands of the American Forces at the present time in France are estimated to be from 50,000 kw. to 60,000 kw. The demands made for electricity are extremely varied. It is not a question of equipping and putting into operation one or two central stations, but rather of providing numerous segregated plants. As a general policy governing the operations of the Technical Board and the electrical division of the Services of Supply, it has been considered best, wherever possible, to make additions to existing French central stations rather than to build new ones, although a certain amount of new work has been undertaken. Another reason for making use of existing central stations, either in their present condition or enlarged, is the difficulty of securing skilled operators. Even when enlarged, such plant can be run by adding a few members to the force already on the job. The French central stations at present have little money for extensions. Such enlargements as are being made for use by the American Expeditionary Forces are being paid for by the United States. The same thing applies to transmission-line construction. Their policy is to adopt overhead construction entirely in connection with the distribution of electrical energy, of which they have already built, or have planned to build, about 132 miles. They are paying for all the lines built, and the understanding with the French Government is that they are the property of the United States. When the war is over it will be possible to recover the material put into the work, or, through some Board of Appraisal, negotiate with the French for its purchase if desired.

The situation is one which involves planning, in order that present enterprises may be adapted to after-the-war conditions. They are putting in now electric power plant and transmission systems which can readily be adapted to peace-time use. In addition to several steam-electric power stations that have been built by American labour in France, there are under consideration half-a-dozen projects for the utilisation of water power by means of the "outdoor type" of electric generating station. The design provides for the utmost simplicity in construction—merely a water-wheel and generator on substantial foundations housed under a rough shed of some sort. The idea is ultimately to make the hydro-electric plant permanent. They will be left in their rough state for the duration of the war, and will then be enclosed in a permanent masonry structure designed by French architects to meet the requirements as to exterior appearance. Hydro-electric plants of this type now under consideration are rated at from 2,000 kw. to 8,000 kw., and will operate under moderate heads. In contrast to these installations is another hydro-electric development of 9,000 kw., which has been partially completed by the French. It is probable that the American Forces will take over this work, finish it, and operate the completed plant. In so far as possible the American-built and French-built systems of electric power transmission will be interconnected. In view of present shipping conditions the Technical Board is endeavouring to procure practically all electrical equipment in France. The French equipment, built to conform to current French practice, is in many cases practically obligatory, especially in view of the fact that it must be used not only for present military needs, but also for commercial service after the war. On many details of electrical power development and transmission, French and American practices are at variance, and certain American equipment would be practically useless. The French employ almost no direct current, the almost universal preference being for 50-cycle, three-phase.

As to equipment and supplies, at the present time there is a decided shortage in transformers and the various miscellaneous supplies urgently needed in the electrical work of the American Expeditionary Forces. In the matter of insulators the shortage is still worse. Much of the clay used in the manufacture of insulators comes from England, and deliveries have fallen off considerably. Special arrangements with manufacturers, providing for coal and clay, however, are now under way. The French have succeeded in producing a glass insulator suitable for service on 35,000-volt lines. The quality of glass it is stated, is far superior to anything which has been produced on a commercial scale in the U.S. One engineer was so impressed with their quality that he said he would not hesitate to use French-made glass insulators on lines carrying voltages of 50,000 or even 60,000.

While the work is complicated by situations not met with in normal times, there are compensating advantages. The chief of these is the thorough way in which the French Ministère 'Armement has mobilised the central stations, controlled the supply of fuel, and regulated the distribution of energy. Not a kilowatt can be produced without the authority of the Ministère de l'Armement. On all electrical matters its word is law. It is vested with powers which greatly simplify the putting into effect of such projects as are required for the uses of the Forces. Close co-operation with the French is accomplishing two objects: it is giving the necessary help in speedily carrying out the projects immediately demanded, and it is laying the foundations for an industrial renaissence in which electric power will assume a place in France never dreamed of before the war.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

17,149. "Locking ring for locking incandescent electric lamps in lamp-holders." N. Edmondson. October 21st.

17,174. "Radio-telegraphy." L. M. Cockaday. October 21st. (U.S.A., October 17th, 1917.)

17,201. "Sparking plugs." K. Smith & J. Walker, Ltd. October 22nd.

17,232. "Clip or fastening for electrical connections." E. Pagnon. October 22nd.

17,231. "Electric accumulator boxes." A. A. Price. October 22nd.

17,242. "Attachment of telegraph wires to insulators of telegraph poles, &c., of aerial wires." W. A. Davis. October 22nd.

17,245. "High-tension continuous-current machine." A. Bolliger. October 22nd. (Switzerland, October 22nd, 1917.)

17,258. "Galvanic batteries." G. Oldham & J. Oldham. October 22nd.

17,259. "Electric signalling, &c., lamps." G. Oldham & J. Oldham. October 22nd.

17,277. "Electrical treatment of gases." L. Bradley. October 23rd. (U.S.A., June 21st, 1916.)

17,279. "Ignition of internal-combustion engines." T. F. Newman. October 23rd.

17,316. "High-speed electric, &c., locomotives." British Thomson-Houston Co. & F. W. Carter. October 23rd.

17,338. "Alkaline accumulators." A. M. Cave. October 23rd. (France, November 28th, 1917.)

17,341. "Combined turbines and electric generators, &c." Brush Electrical Engineering Co. & W. Chilton. October 23rd.

17,342. "Turbine and electrical generator plants." Brush Electrical Engineering Co. & W. Chilton. October 23rd.

17,359. "Sparking plugs for internal-combustion engines." F. A. L. Johnson. October 24th.

17,373. "Means for effecting electric synchronised control." H. Dickinson. October 24th.

17,386. "Sparking plugs for ignition purposes." A. E. Heath. October 24th.

17,395. "Utilising thermic effect of cathode rays." A. Sinding-Larsen. October 24th. (Norway, December 7th, 1917.)

17,398. "Alternating current and welding apparatus." C. J. Holslag. October 24th. (U.S.A., October 24th, 1917.)

17,404. "Electric switches." A. H. F. Peel. October 24th.

17,420. "Electric aeroplane bicycle, &c." H. M. Gloyne. October 25th.

17,429. "Ignition apparatus for internal-combustion engines." American Wallet Engine Co. October 25th. (U.S.A., November 2nd, 1917.)

17,442. "Electric make-and-break switches." Edison Swan Electric Co. and F. Shergold. October 25th.

17,454. "Producing a high vacuum." British Thomson-Houston Co. (General Electric Co., U.S.A.) October 25th.

17,466. "Gas exits for galvanic batteries." G. Oldham & J. Oldham. October 25th.

17,476. "Means for gripping flexible conductors or cords of electric lamp-holders." M. J. Railing & T. Taylor. October 26th.

17,504. "Electric switches." M. D. Scott. October 26th.

17,513. "High-frequency alternators and their use as relays in wireless telephony." Soc. Francaise Radio-Electrique. October 26th. (France, October 26th, 1917.)

17,514. "Telephonic apparatus." M. Latour. October 26th. (France, October 3rd, 1917.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

12,284. Junction-box coupling for electric conduits. J. N. Scism. August 27th, 1917. (119,491.)

14,035. Cooling arrangements for dynamo-electric machines. H. C. E. Picoby & Enclosed Motor Co. September 28th, 1917. (119,505.)

14,092. Electrical gyroscopes. A. H. Midgley & C. A. Vandervell and Co. September 29th, 1917. (119,511.)

14,201. Electric welding apparatus. R. F. Woodburn. October 2nd, 1917. (119,520.)

14,254. Telegraph or like signalling systems. T. B. Dixon. October 2nd, 1917. (119,524.)

14,309. Electric storage batteries or electric accumulators. Fuller Accumulator Co. & J. C. Wood. October 3rd, 1917. (119,530.)

14,393. Incandescent electric lampholders. M. H. Goldstone. October 5th, 1917. (119,539.)

14,598. Alternating-current generators. T. F. Wall. October 9th, 1917. (119,546.)

15,020. Reversing motors for planing machines and the like. G. Stirk, E. Stirk, R. Stirk & J. G. Stirk. October 17th, 1917. (119,555.)

15,214. Electric battery lamps. W. A. S. Hellyar. October 19th, 1917. (119,560.)

18,487. Electric cables. Pirelli & Co. March 26th, 1917. (114,414.)

18,847. Cradle for use in supporting electric cables and their fittings. December 19th, 1917. (119,585.)

1918.

374. Electric switches. G. O. Donovan & W. Donovan. January 10th, 1918. (119,592.)

2,648. Gas fires, electric radiators, and the like. C. Wray. February 14th, 1918. (119,604.)

3,869. Timing devices for ignition magnetos. Compagnie Générale de Magnetos. May 4th, 1917. (115,619.)